A Dissertation on

A STUDY ON LIMB SPARING SURGERY ON EXTREMITY SOFT TISSUE SARCOMA

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BONAFIDE CERTIFICATE

Certified that the dissertation titled **"A STUDY ON LIMB SPARING SURGERY ON EXTREMITY SOFT TISSUE SARCOMA"** is a bonafide work of the Candidate **Dr.S.MARIMUTHU,** carried under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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CONTENTS

STUDY ON LIMB SPARING SURGERY IN EXTREMITY SOFT TISSUE SARCOMA

1. INTRODUCTION

Soft tissue sarcomas are the most frequent sarcomas. They are a rare and heterogeneous group of tumors that arise from the supporting extra skeletal tissues (i.e., muscle, fascia, nerve, connective, fibrous, and fatty tissues. Although soft tissues comprise 75% of the average body weight, these neoplasms represent less than 1% of all adult and 15% of pediatric malignancies. Soft tissue sarcomas are a disease of adulthood, occurring most commonly in persons between 30 and 60 years of age. The sole exception is rhabdomyosarcoma, which occurs in young children.

Each of the various soft tissue sarcomas has a unique morphology, biological behavior, and prognosis. However, like bone sarcomas, they all share certain biological and behavioral characteristics. The clinical, radiographic, and surgical management of most soft tissue sarcomas is identical, regardless of histogenesis.

The treatment of soft tissue sarcoma has become multidisciplinary, as advances in biology, imaging, surgery, chemotherapy and radiotherapy have improved the outlook for these patients who have these malignancies.

Before 1970s, the standard treatment for any primary soft-tissue sarcomas of the extremities was amputation of the affected arm or leg. Since then, better understanding of the biological behavior of these tumors and advances in surgical technique, bioengineering, radiographic imaging, radiotherapy, and chemotherapy have led to the advent of limb-sparing surgery.

Limb-sparing surgery is now a safe and effective method of treatment for many, if not most, individuals. The goal of limb-sparing surgery is safe and complete removal of the tumor with preservation of limb function.

Limb-sparing surgery is now the standard of care for bone and soft tissue sarcomas of the extremities and is performed in approximately 90% of all cases. All patients must be considered and evaluated for limb-sparing surgery, and the decision to proceed with an amputation should be made on a case-by-case basis. Such decisions are based on local anatomic considerations, tumor grade and stage, and consideration of the functional and psychological impact of the procedure.

2. AIM OF STUDY

1. To study the incidence of soft tissue sarcoma in our institution.
2. To study the rate of limb sparing surgery and amputations
3. To study age distribution and sex incidence.
4. To study the presentations of soft tissue sarcoma on diagnosis.
5. To study stage of the disease at presentation.
6. To study the incidence of various pathological types.
7. To study the surgical management, reconstruction techniques, complications and their management
8. To study the functional outcome after limb sparing surgery.
9. To study the oncological outcome after limb sparing surgery.

3. REVIEW OF LITERATURE

History

The word sarcoma dates to Galen and the Greek term describing a fleshy growth. The idea of a sarcoma as a distinct type of cancer was not formalized until the mid 1800s by Virchow.

The first successful hemipelvectomy was reported by Cherles Girard, in 1895, for a recurrent osteosarcoma. Over the next several decades, hemipelvectomy (also known as interpelvic, interilioabdominal, interinominoabdominal, interiliosacropubic, transiliac, or hindquarter amputation) became the standard surgical treatment for sarcomas of the proximal lower extremity, inguinal region, buttock, and musculoskeletal hemi pelvis.

The first successful forequarter amputation was performed by Grosby, in 1836, for osteosarcoma.

Without challenge, the most radical of all potential sarcoma surgeries is the translumbar amputation or hemicorporectomy. First postulated by Kredel, in 1950 (as the “halfectomy”), but not successfully performed until 1961 by Aust and Absolon. This rare procedure has been reserved for extensive but isolated benign and malignant processes involving the pelvis, including skeletal and soft tissue tumors.

Beginning as early as the 1930s, the necessity of amputation in all cases of soft tissue sarcoma began to be questioned. In 1958, Bowden and Booher published a classic paper on

the fundamental shift in the principles and techniques of sarcoma surgery. In a series of 36 patients treated with limb sparing muscle group wide excision, their local recurrence rate was a very reasonable 16%.

These ideas did not mature into the modern concept of multimodality limb conservation until the 1980s. One of the seminal studies to solidify the potential equivalence of limb conservation to amputation was performed by Rosenberg at the national cancer institute from 1975 to 1981. Based upon the results from his study and other studies, a National Institute of health Consensus Development Conference in 1984 on “Limb-Sparing treatment of Adult Soft Tissue Sarcomas” concluded that there is clearly a role for limb-sparing surgery, often by combining surgery with radiation or chemotherapy.

From this point forward, the emphasis on the treatment of soft tissue sarcomas shifted from extensive amputations to limb preservation strategies, post resection functionality and quality of life.

The modern radical resection and reconstructive approaches are mainly contributed by major developments in micro vascular plastic surgical techniques, an increased emphasis on functionality, the development of prosthetic materials, neurovascular reconstruction, down staging with isolated limb perfusion, and the concept of limb remodeling and replantation.

As a consequence, although amputation was once considered the standard of care for extremity sarcomas, “amputation free survival” has become an important clinical outcome in the treatment of this disease.

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Incidence

Soft tissue sarcoma represents less than 1% of all adult and 15% of pediatric malignancies. Incidence of soft tissue sarcoma is more than bone sarcoma with ratio of 3:1. Incidence is more in male than female (Ratio - 4:1). It is rarer than benign soft tissue tumors with ratio of 1:100.

Soft tissue sarcomas are a disease of adulthood, occurring most commonly in persons between 30 and 60 years of age. The sole exception is rhabdomyosarcoma, which occurs in young children.

Distribution

Soft tissue sarcoma can occur in any site throughout the body. Forty three percent are in extremities with two thirds of extremity lesions occurring in the lower limb, and 34% are intra-abdominal, divided between visceral (19%) and retroperitoneal (15%) lesions. Trunk sarcoma occurs in 10% of individuals and others in 10% of patients.

Etiology

Most soft tissue sarcomas have no clearly defined cause, although multiple associated or predisposing factors have been identified.

Various genetic syndrome which are predisposing to soft tissue sarcoma are neurofibromatosis type 1, retinoblastoma, LI-Fraumeni syndrome, Gardner’s syndrome, Werner’s syndrome, Goblin’s syndrome, Carney’s triad and tuberous sclerosis.

Radiation therapy is the known cause of soft tissue sarcoma. They are most often seen in diseases that are commonly treated with radiotherapy and in those in which a long survival

period is expected. The prime candidate diseases are breast cancer, lymphoma, and cervical cancer. The children are at risk due to time latency involved. It arises close to penumbra of radiotherapy fields.

Most common tumors following radiotherapy are osteosarcoma followed by Malignant Fibrous Histiocytoma, angiosarcoma or lymphangiosarcoma. Usually the tumor is high grade.

Lymphedema has long been established as a factor in the development of lymphangiosarcoma. The most well recognized association is with the post mastectomy, post irradiated lymphadematous arm, described by Stewart and Treves. This is not radiation induced sarcoma

Human herpes virus 8 is cause of Kaposi's sarcoma. Epstein-Barr virus is implicated in soft tissue sarcoma in immune compromised people. Chemicals implicated in etiology are Phenoxy acetic acid, Vinyl chloride, Thorotrast, arsenic.

The issue of trauma as a predisposing factor is more controversial. Often a minor episode of injury is the factor that draws attention to the presence of a mass.

Classification

It is based on line of differentiation i.e. the type of tissue formed rather than from the type of origin. WHO's classification is used widely.

- Fibrous tumors
- Fibrohistiocytic tumors
- Lipomatous tumors
- Smooth muscle tumors

- Skeletal muscle tumors
- Tumors of Blood vessels & lymphatics
- Perivascular tumors
- Synovial tumors
- Mesothelial tumors
- Peripheral N. sheath tumors
- Primitive neuroectodermal tumors(PNET)
- Extra skeletal osseous & cartilagenous tumors
- Miscellaneous tumors

The basis cell appearance on smears, they are classified clinically as follows

- Myxoid tumors
- Spindle cell tumors
- Pleomorphic tumors
- Polygonal tumors
- Round cell tumors
- Miscellaneous

Pathology

The three most common histopathologic subtypes are MFH, liposarcoma, and leiomyosarcoma. Histopathologic type is anatomic site dependent. The common subtypes in the extremities are liposarcoma, MFH, synovial sarcoma and fibrosarcoma. Synovial sarcoma is common in hand and foot. In the skin, Kaposi's sarcoma in common.

Soft tissue sarcoma is differentiated from benign soft tissue tumors from its aggressive growth, invasive and destructive potential, occurrence of metastases and high rate local recurrence if not treated adequately.

Grading of sarcoma

After establishing the diagnosis of sarcoma, the most critical piece of information the pathologist can provide to the clinician is histologic grade. This remains the most important prognostic factor for determining disease-free and overall survival rate.

The pathologic features that define grade include cellularity, differentiation, pleomorphism, necrosis, and number of mitoses.

Unfortunately, the criteria for grading are neither specific nor standardized. Several grading scales and systems are used: a four-grade system (Broder's), a three-grade system (low, intermediate, high) such as National Cancer Instituite (NCI) grading system and that of the French Federation of Cancer Centers Sarcoma group, and a binary system (low, high) as is used at Memorial Hospital.

Many pathologists consider mitotic activity and degree of necrosis to be the most important pathologic features. To define a practical grading system, the European Organization for Research and treatment of cancer (EORTC) conducted a study in which, the multivariate analysis showed only mitotic count (fewer than 3, 3 to 20, and more than 20 mitoses per 10 consecutive high-power fields), the presence or absence of necrosis, and tumor size predicted survival.

Biologic markers such as mutation of p53, nuclear over expression of p53, and a high Ki-67 proliferation index are associated with high grade and poor survival, but not a independent indicators of prognosis and cannot at present be used to grade sarcomas

Several tumors that are considered sarcomas have no recognizable normal tissue counterpart (e.g., alveolar soft part tumor, Ewing's sarcoma, Epithelioid sarcoma). These tumors often have unique clinical features and usually are not graded.

In 2002 AJCC/TNM staging system of sarcoma, only two grades, low versus high are used to stage soft tissue sarcomas. To accurately determine tumor grade, an adequate tissue sample must be well fixed, well stained, and reviewed by an experienced sarcoma pathologist.

Staging

Staging has an important role in determining the most effective treatment of soft tissue sarcomas. The stage is determined by the size of the tumor, the histologic grade, and whether it has spread to lymph nodes or distant sites. Intracompartmental or extra compartmental extension of extremity sarcomas is also important for surgical decision making. For complete staging, a thorough physical examination, x-rays, laboratory studies, and careful review of all biopsy specimens (including those from the primary tumor, lymph nodes, or other suspicious lesions) are essential. Computed tomographic scan of the chest is recommended for sarcomas larger than 5 cm (T2) or with moderate to poor differentiation (grades 2–4). Nodal involvement is rare, occurring in other less than 3% of patients with sarcoma

The staging system applies to all soft tissue sarcomas except Kaposi's sarcoma,

dermatofibrosarcoma, infantile fibrosarcoma, and angiosarcoma. In addition, sarcomas arising within the confines of the dura mater, including the brain, and sarcomas arising in parenchymatous organs and from hollow viscera are not optimally staged by this system.

Data to support this staging system are based on current analyses from multiple institutions and represent the recommendations of an AJCC task force on soft tissue sarcoma. In the era of cytoreductive neoadjuvant treatments, clinical and pathologic staging may be altered in the future. Because pathologic staging drives adjuvant therapy decisions, patients should be restaged after neoadjuvant therapies have been administered.

Histologic type, grade, and tumor size and depth are essential for staging. Histologic grade of sarcoma is one of the most important parameters of the staging system. Grade is based on analysis of various pathologic features of a tumor, such as histologic subtype, degree of differentiation, mitotic activity, and necrosis. Accurate grading requires an adequate sample of well-fixed tissue for evaluation. Accurate grading is not always possible on the basis of needle biopsies or in tumors that have been previously irradiated or treated with chemotherapy.

The current staging system does not take into account anatomic site. However, anatomic site is known to influence outcome, and therefore outcome data should be reported specifying site. Generic grouping of site is accepted. The following site groups can be used in reports that include sarcomas arising in tissues other than soft tissues (such as parenchymal organs). Extremity and superficial trunk can be combined; viscera, including all the intra-abdominal viscera, can also be combined. Where enough numbers exist, these can be reported by

subdivision into the various components of the gastrointestinal tract. Lung, gastrointestinal, genitourinary, and gynecologic sarcomas should be grouped separately.

Site Groups for Soft Tissue Sarcomas

Head and neck

Extremity and superficial trunk

Gastrointestinal

Genitourinary

Visceral

Retroperitoneal

Gynecologic

Breast

Lung, pleura, mediastinum

Inclusions

The present staging system applies to soft tissue sarcomas. Primary sarcomas can arise from a variety of soft tissues. These tissues include fibrous connective tissue, fat, smooth or striated muscle, vascular tissue, peripheral neural tissue, and visceral tissue.

Regional Lymph Nodes

Involvement of regional lymph nodes by soft tissue sarcomas is uncommon in adults. When present, regional nodal disease has prognostic significance similar to that of visceral metastatic disease.

Metastatic Sites

Metastatic sites for soft tissue sarcoma are often dependent on the original site of the primary lesion. For example, the most common site of metastatic disease for patients with extremity sarcomas is the lung, whereas retroperitoneal and gastrointestinal sarcomas often have liver as the first site of metastasis.

TNM / The American Joint Committee on Cancer (AJCC) has designated staging by the four criteria of tumor size, nodal status, grade, and metastasis (TNGM).

Grade and TNM Definitions

Tumor grade (G)

- GX: Grade cannot be assessed
- G1: Well differentiated
- G2: Moderately differentiated
- G3: Poorly differentiated
- G4: Poorly differentiated or undifferentiated

Primary tumor (T)

- TX: Primary tumor cannot be assessed
- T0: No evidence of primary tumor
- T1: Tumor 5 cm or less in greatest dimension
    - T1a: Superficial tumor

    - T1b: Deep tumor
- T2: Tumor 5 cm or larger in greatest dimension
    - T2a: Superficial tumor
    - T2b: Deep tumor

Regional lymph nodes (N)

- NX: Regional lymph nodes cannot be assessed
- N0: No regional lymph node metastasis
- N1: Regional lymph node metastasis [Note: Presence of positive nodes (N1) is considered stage IV.]

Distant metastasis (M)

- MX: Distant metastasis cannot be assessed
- M0: No distant metastasis
- M1: Distant metastasis

NOTES

1. Superficial tumor is located exclusively above the superficial fascia without invasion of the fascia; deep tumor is located either exclusively beneath the superficial fascia, superficial to the fascia with invasion of or through the fascia, or both superficial yet beneath the fascia. Retroperitoneal, mediastinal, and pelvic sarcomas are classified as deep tumors.

2. Ewing's sarcoma is classified as G4.

STAGE GROUPING

IA	T1a	N0	NX	M0	G1–2	G1	Low

	T1b	N0	NX	M0	G1–2	G1	Low
IB	T2a	N0	NX	M0	G1–2	G1	Low
	T2b	N0	NX	M0	G1–2	G1	Low
IIA	T1a	N0	NX	M0	G3–4	G2–3	High
	T1b	N0	NX	M0	G3–4	G2–3	High
IIB	T2a	N0	NX	M0	G3–4	G2–3	High
III	T2b	N0	NX	M0	G3–4	G2–3	High
IV	Any T	N1		M0	Any G	Any G	High or Low
	Any T	Any N		M1	Any G	Any G	High or Low

Evaluation and Workup

All patients should be managed by a multidisciplinary team with expertise in soft-tissue sarcoma. The differential diagnosis of soft tissue sarcomas of the extremities includes ruling out desmoids, as well as the other malignant and benign lesions previously discussed. An essential element of the workup is a history and physical examination (H&P).

Laboratory tests have a limited role. Adequate and high-quality imaging studies are crucial to good clinical management of patients, because the presence of metastatic disease may change the management of the primary lesion and the overall approach to the patient's disease management. Imaging studies should also provide details about tumor size and contiguity to nearby visceral structures and neurovascular landmarks.

Magnetic resonance imaging (MRI) with or without computed tomography (CT) is indicated for all lesions with a reasonable chance of being malignant. MRI is preferred for extremity sarcomas, whereas CT is preferred for retroperitoneal sarcomas. Plain radiograph of the primary lesion is optional. CT scan is done to image the primary if there is suspicion of involvement of bone.

Given the risk for hematogenous spread from soft tissue sarcoma to the lungs, imaging of the chest is essential for accurate staging. Abdominal/pelvic CT should be considered for myxoid liposarcoma, leiomyosarcoma, epithelioid sarcoma or angiosarcoma.

18Fluorodeoxyglucose-positron emission tomography (18FDG-PET) scan may be useful for prognostication, grading and to assess response to chemotherapy. Tumor metabolism data acquired by FDG-PET will be useful in accurate grading and prognostication in sarcoma. Recent reports in literature have demonstrated the value of FDG-PET scan in evaluating response to neoadjuvant chemotherapy in patients with high-grade extremity soft tissue sarcomas, prediction of outcome in liposarcoma.

A large prospective study is underway to study the value of FDG-PET scan combined with CT scan in predicting disease-free survival in patients receiving neoadjuvant chemotherapy for soft tissue sarcoma

BIOPSY

Biopsy is a key step in the diagnosis of soft-tissue tumors. An inadequately performed biopsy may fail to allow proper diagnosis, have a negative impact on survival, and ultimately necessitate an amputation to accomplish adequate margins of resection.

In a book published in 1958, Jaffe stated that a biopsy should be regarded as the final diagnostic procedure, not as a mere short cut to diagnosis. Biopsy must be preceded by careful clinical evaluation and analysis of the imaging studies. The diagnosis of a musculoskeletal lesion is based on these three parameters; all three have to fit and the diagnosis must be questioned when they do not match.

In the past, biopsies were performed routinely through a large incision with significant contamination of the surrounding soft tissues with tumor cells. The contamination, however, had minimal significance because most malignant tumors of the extremities and pelvis were treated with amputation.

Today, limb sparing procedures are performed in 90–95% of patients with musculoskeletal tumors of the extremities, and indications and surgical technique of musculoskeletal biopsy had to be changed to allow these procedures to be performed.

Biopsy Considerations

Biopsy of a musculoskeletal lesion should be performed only at the conclusion of staging, which is the process that entails performing the imaging studies required to determine the characteristics and local extent of the tumor and the presence of metastatic disease.

Anatomic Location of the Biopsy Tract

The guidelines can be summarized as follows:

1. Decide, before biopsy, what part of the lesion is most representative of the underlying disease and will need to have a biopsy.
2. Position the point of entry along the planned incision of the definitive surgery.
3. The biopsy tract must be the shortest way to the lesion; however, it must not violate
4. more than one compartment and must be as remote as possible from the main neurovascular bundle of the extremity

Biopsy Technique

After adequate planning of the biopsy tract, biopsy should be executed according to the following guidelines.

1. Use the smallest longitudinal incision that is compatible with obtaining an adequate specimen. Transverse incisions are contraindicated because they require a wider soft-tissue resection at the time of definitive surgery
2. Use a knife or curette to avoid crushing or distorting the specimen's texture
3. Obtain enough tissue. Always send a specimen for frozen section or touch-prep to verify the presence of representative tumor material in the specimen. For needle biopsies, cytopathologic evaluation has to confirm the presence of viable tumor cells. If pathologic evaluation is negative or questionable, repeat the biopsy.
4. As a general rule, culture what you biopsy and biopsy what you culture.
5. Use meticulous hemostasis. Any hematoma around a tumor should be considered contaminated
6. Use drains if necessary. The port of entry has to be in proximity and continuation with the skin incision, not to its sides. The drain path is considered contaminated and has to be excised with the surgical specimen.

Types of biopsy

In soft tissue sarcoma, core needle biopsy, incisional biopsy and excision biopsy are used depending upon the situations. In most of the situation, Core needle biopsies are adequate and therefore recommended. In rare circumstances. Incisional biopsy is required. In tumors smaller than 5 cm, with superficial location excisional biopsy is the preferred approach.

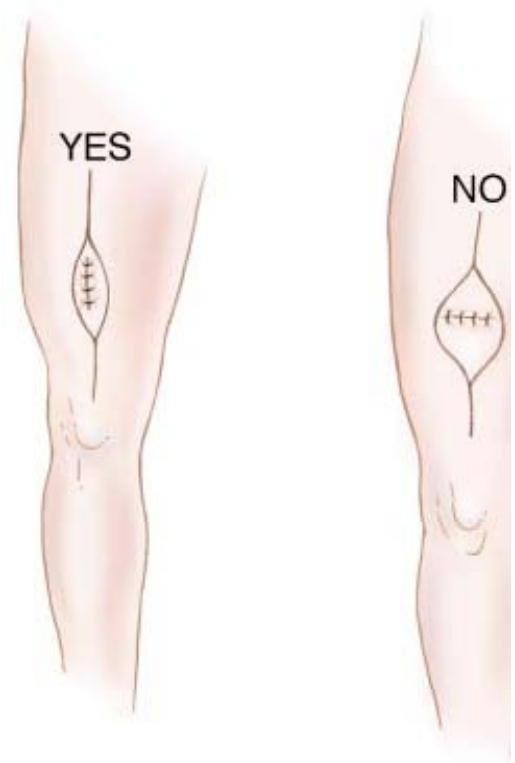
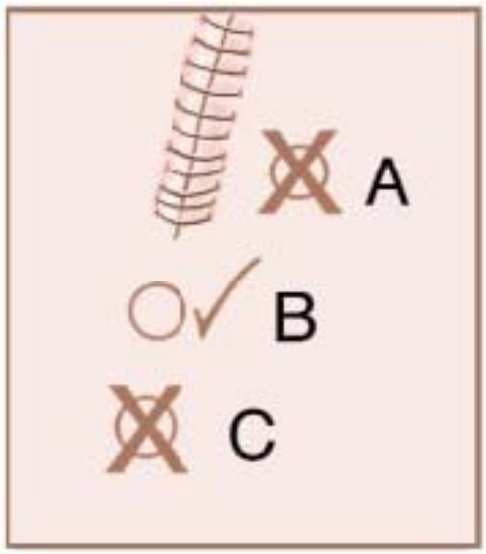


Figure. The smallest longitudinal incision that allows an adequate specimen to be obtained should be used. A transverse biopsy incision requires a wider resection of soft tissues at the time of the definitive surgery.



igure. A drain has to be positioned in oximity to and along the site for anned incision of the definitive ocedure.

Value of Tru-Cut Biopsy

In general, the important issue is the adequacy of the sample. Sufficient viable tissue is required that is both representative of the lesion and available for histopathologic evaluation, immunohistochemistry, and, when necessary, electron microscopy. As molecular markers become a factor in diagnosis, meticulous attention to the adequacy of biopsy, tissue preservation, and evaluation will be paramount.

Histopathologic interpretation varies from center to center and may be a major variable in decision making. As with other relatively rare lesions, it is essential that review of the histopathologic findings be made by an experienced group. More recent studies show improved diagnostic accuracy and confluence of opinion, at least for malignancy and grade.

Fine-Needle Aspiration Cytology

Fine-needle aspiration (FNA) cytology has been examined by a number of authors. Some authors have argued that biopsy itself is not justified if FNA is available. But it is usually confined to the confirmation of recurrence rather than used for the primary diagnosis.

The use of FNA in patients with large sarcomas who are candidates for neoadjuvant therapy to improve survival is also problematic due to difficulty in grading and subtyping these tumors accurately from such small samples.

Frozen Section

In some institutions, frozen section is relied on as the diagnostic tool of choice. For diagnosis of malignancy, frozen section is accurate, but for histopathologic subtypes and grade, it is inferior to permanent sections of either Tru-Cut or incisional biopsy.

Frozen section can guide retrieval of adequate diagnostic material and, depending on the initial evaluation, can be an important triage mechanism to direct further pathologic workup. However, open biopsy with the help of frozen-sectioning support may be indicated when the Trucut biopsy result is equivocal or for other clinical reasons.

Fatty lesions are not suitable for frozen-section evaluation, because of a loss of diagnostic material during frozen sectioning and other technical difficulties. In addition, freezing compromises the final interpretation on permanent sections.

Important application of frozen section is assessment of margin of resection. Negative margins of resection can be obtained by using this technique intraoperatively.

Immunohistochemistry

As an ancillary technique, immunohistochemistry is an invaluable tool that provides excellent information in assisting the surgical pathologist in establishing a precise diagnosis, as well as providing relevant prognostic and therapeutic information.

One of its major utilities is to correctly identify a tumor as being of mesenchymal or nonmesenchymal origin. Once mesenchymal origin has been established, histologic subtyping according to specific cell lineage may be achieved with the use of lineage-specific markers. Tumors of uncertain cell lineage and tumors with primitive small round cell morphology are often characterized by a unique immunohistochemical phenotype. In this group of tumors, immunohistochemistry is most widely applied and is of greatest value. By diagnosing the small round cell tumors with aid of immunohistochemistry, line of management is differed from spindle cell soft tissue tumors.

Despite the rapid development of molecular genetic techniques, immunohistochemistry still remains the most important diagnostic tool in the diagnosis of soft tissue tumors aside from recognition of morphologic features and clinical correlation.

Surgery

Although surgery remains the principal therapeutic modality, the extent of surgery required, along with the optimum combination of radiotherapy and chemotherapy, remains controversial.

Limb sparing operations are possible in at least 90% of patients. Wide en bloc resection is used most often, aiming to obtain a 2 cm margin of uninvolved tissue in all directions. The

limiting factor is usually neurovascular or, occasionally, bony juxtaposition. Because most soft tissue sarcomas tend not to invade bone directly, only rarely does bone need to be resected. Soft tissue sarcomas uncommonly involve the skin, so major skin resection should be limited.

In situations of primary or recurrent tumors in which skin is involved, or which the tumor is so extensive that skin is involved, then consideration of free flap or rotational flap closure becomes important, particularly in those patients who are candidates for subsequent adjuvant radiation therapy.

Amputation for Extremity Sarcoma

The most extensive resection is clearly amputation. This is only rarely indicated nowadays. The amputation should be reserved for tumors not able to be resected by any other means, without evidence of metastatic disease and the potential for good long-term functional rehabilitation. This includes patients with considerable cosmetic and functional deformity, who can be rendered symptom free by a major amputation.

Amputation should be considered for patient preference or if the tumor has the following characteristics: extensive soft tissue mass and/or skin involvement, major arterial or nerve involvement, extensive bony involvement that requires whole bone resection, failure of preoperative therapy or recurrence following prior adjuvant radiation.

The issue of amputation versus limb sparing surgery has been addressed by a prospective randomized trial at the NCI. Although local recurrence is greater in those undergoing limb

sparing operation plus radiation than in those undergoing amputation, disease free survival is not different.

Local recurrence

Local recurrence can occur after a limb sparing surgery. Follow up data confirms that salvage is almost invariably possible, but there is no impact in long term survival.

CLASSIFICATION OF SURGICAL PROCEDURES

There are four basic types of excisions (**see the figure**). Each is based on the relationship of the dissection plane to the tumor and its pseudocapsule.

An **intralesional** excision is performed within the tumor mass and results in removal of only a portion of it; the pseudocapsule and macroscopic tumors are left behind.

In a **marginal** excision, the dissection plane passes through the pseudocapsule of the tumor. Such a resection may leave microscopic disease.

Wide (en-bloc) excision entails removal of the tumor, its pseudocapsule, and a cuff of normal tissue peripheral to the tumor in all directions. This is the desired margin for sarcoma resection; however, the adequate thickness of the normal tissue cuff is a matter of controversy. For both soft-tissue and bone sarcomas, it is generally believed to be a few centimeters.

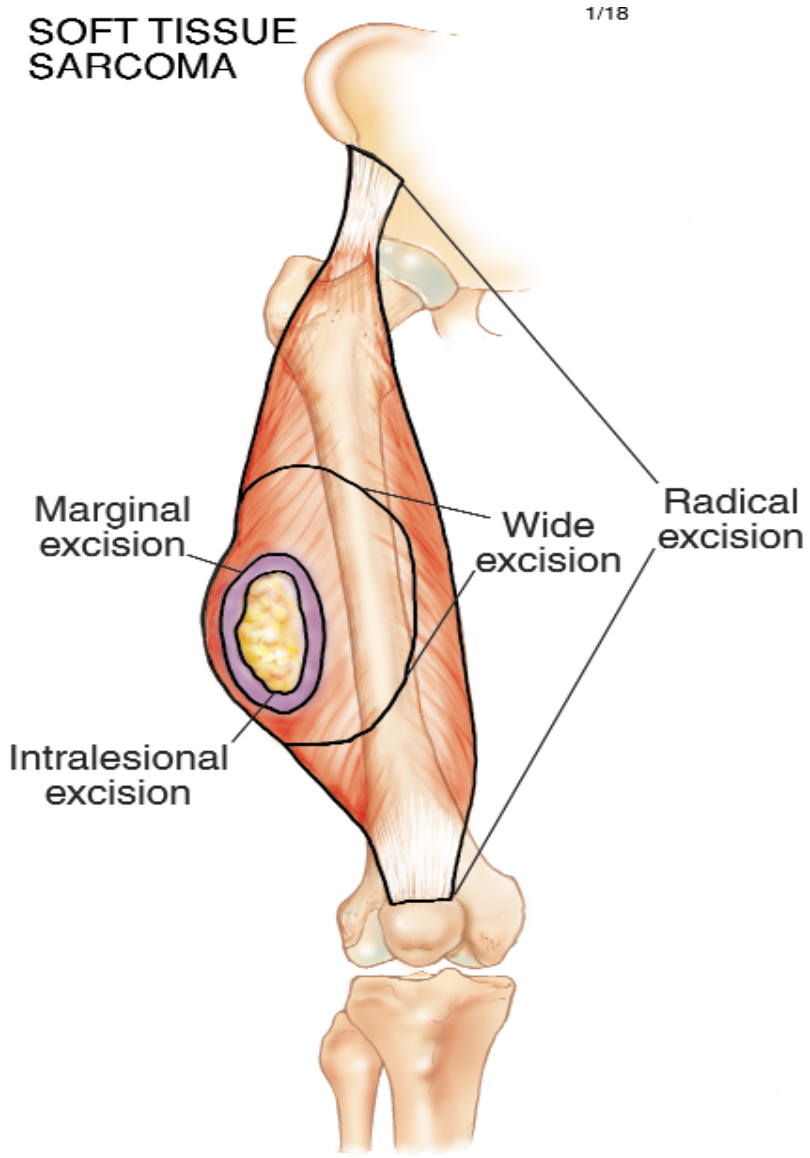


Figure. Various excision types for soft-tissue sarcoma.

Radical excision involves removal of the tumor and the entire anatomical compartment within which it is located. Traditionally it is mentioned as the fourth excision type. It excludes the possibility of skip metastases. In compartmental resections, fascia and periosteum are accepted as wide margin.

An amputation is *not* necessarily an adequate cancer operation, but it is a method of achieving a specific margin. It may entail a marginal, wide, or radical excision, depending upon the plane in which it passes. Staging studies are used to assess local tumor extent and relevant local anatomy, and thereby determine how a desired surgical margin may be achieved.

RADIATION THERAPY

Preoperative RT

The usual dose of preoperative RT is 50 Gy. An intraoperative boost or a postoperative boost with brachytherapy or an external-beam RT is recommended for positive or close margins. Preoperative RT has several advantages. First, the treatment volume is smaller, because the need to cover the operative field is not present. Second, preoperative radiation may reduce seeding during surgical manipulation of the tumor. The tumor may or may not regress with preoperative RT, but the pseudocapsule may thicken and become acellular, easing resection and decreasing the risk of recurrence. However, the main disadvantage of preoperative RT is its effect on wound healing. A higher complication rate has been observed when primary closure is used. Therefore, involvement of a plastic surgeon in the team may be necessary to reduce wound complications when preoperative radiation is contemplated. After preoperative radiation, 3-6 weeks interval before resection is necessary to decrease the risk of wound complications. Very long intervals between resection and postoperative radiation are not recommended.

If wide margins are obtained, additional radiation may not be needed. Often, margins are close because of the proximity of many of these tumors to major neurovascular bundles or bone. At the time of resection, surgical clips should outline the area of recurrence risk.

Brachytherapy boosts should be delivered several days after surgery, through catheters placed at operation, with doses of 12-20 Gy based on margin status. Alternatively, a single intraoperative dose to the tumor bed of 10-16 Gy, based on margin status, can be delivered immediately after resection with exposure of the area at risk, avoiding uninvolved organs. External-beam RT boosts may be an alternative to brachytherapy or intraoperative radiation: recommended doses are 10-14 Gy for close margins, 16-20 Gy for microscopically positive margins, and 20-26 Gy for grossly positive margins. Many institutions are no longer giving a boost after preoperative radiation to patients who have widely negative margins, based on local control rates that

approach 95% with preoperative radiation at 50 Gy and negative margins.

Postoperative RT

Postoperative RT has been to improve local control in patients with high-grade extremity soft tissue sarcomas with positive surgical margins. When surgical resection is the initial therapy, postoperative RT choices include intraoperative radiation therapy (IORT), brachytherapy or external beam RT. RT is not a substitute for suboptimal surgical resection, and re-resection may be necessary. If the patient has not previously received RT, one could attempt to control microscopic residual disease with postoperative RT if re-resection is not feasible.

External-beam RT is delivered to large fields after surgical healing is complete (at 3-8 weeks) to doses of 50 Gy. Most institutions include the entire operative bed within that radiation field. Total doses of RT should always be determined by normal tissue tolerance. For intraabdominal or retroperitoneal tumors, this dose may be decreased to 45 Gy. An intraoperative boost may not be possible if radiation morbidity is high.

If no intraoperative radiation or brachytherapy was used in the immediate operative or postoperative period, an external-beam RT boost should be added. For negative margins, an additional 10-16 Gy is recommended to a reduced field that includes the original tumor bed, based on grade and width of margins. For microscopically positive margins, an additional 16-20 Gy is recommended; for grossly positive margins, an additional 20-26 Gy is suggested.

Brachytherapy alone has been used as an adjuvant in patients with negative margins. 45-50 Gy to the tumor bed has been shown to reduce recurrence without a significant effect on wound healing. However, brachytherapy-alone techniques require special expertise and significant experience. If brachytherapy is used as a boost, doses of 10-20 Gy based on margin are recommended; a boost dose of 10-16 Gy for close margins or 20 Gy for positive margins is recommended.

Recent reports from a retrospective study suggest that IORT provides excellent local control to soft tissue sarcoma of the extremity, when used as a boost to external beam RT.

TREATMENT

Low Grade Tumors (Stage I)

Surgery is the primary treatment for stage I (T1a-1b, N0, M0) low-grade tumors and is considered definitive if margins are greater than 1 cm or the fascia plane is intact. Postoperative RT is considered when final margins are 1 cm or less (category 2B). Surgical resection alone or in combination with RT (category 1) is recommended for stage I (T2a-b,

N0, M0) low-grade tumors. RT may not be necessary in patients with small lesions (5 cm or less), because these tumors are less frequently associated with local recurrence.

There are data from two randomized trials and three large single-institution studies that support using adjunctive RT in appropriately selected patients. Patients receiving either preoperative or postoperative RT have similar rates of local control and progression-free survival. However, preoperative RT is associated with a greater incidence of wound complications, especially in lower extremity tumors. Therefore, the risk of local recurrence versus the toxicity of adjuvant RT should be assessed before making a decision regarding radiation.

High-Grade Tumors (Stage II or III)

Large high-grade extremity sarcomas (greater than 10 cm) at high risk for local recurrences and metastases and should be considered for preoperative therapy. Preoperative chemotherapy or chemoradiation is used in many centers for high-grade tumors to downstage a large tumor to enable effective surgical resection, especially in the case of chemo sensitive histologies. Concurrent chemoradiation with doxorubicin-based regimens has been shown to improve local control rates in patients with soft tissue sarcoma. Available evidence although underpowered, suggests that anthracycline-based postoperative chemotherapy would improve disease-free survival in selected patients who are at high risk of recurrence but otherwise are in good performance status.

Sarcoma Meta Analysis Corporation performed a meta-analysis of 14 randomized trials (1,568 patients) which compared adjuvant chemotherapy to follow-up and in some cases

radiation therapy after surgery with a variety of sarcomas. The result of the meta-analysis showed that doxorubicin-based chemotherapy prolongs relapse-free survival in adults with localized, resectable soft tissue sarcoma of the extremity and was associated with decreased recurrence rates. However, adjuvant chemotherapy does not appear to improve overall survival. Another recent analysis of 674 patients with stage III soft tissue sarcoma (1984-1999) revealed that clinical benefits from doxorubicin-based chemotherapy lasted for less than a year. In an Italian randomized cooperative trial, patients with high-grade or recurrent extremity sarcoma were randomized to receive postoperative chemotherapy with epirubicin and ifosfamide or observation alone. After
a median follow-up of 59 months, median disease-free survival (48 months vs.16 months) and median overall survival (75 months vs. 46 months) were significantly better in the treatment group.

Remarkably little data have been generated in the adjuvant setting regarding the combination of aggressively dosed ifosfamide plus doxorubicin supported by hematopoietic cytokine therapy. Phase III randomized study (EORTC-62931) is ongoing to assess the efficacy of adjuvant chemotherapy after definitive surgery in patients with
high-grade primary or recurrent soft tissue sarcoma at any site. Interim overall survival data are encouraging from an ongoing phase III trial (EORTC-62961) of regional hyperthermia versus chemotherapy (etoposide, ifosfamide, adriamycin) alone for patients with high-risk soft tissue sarcomas, especially for extremity sarcomas.

Treatment options for stage II or III high-grade tumors should be decided by a multidisciplinary team, based on the performance status, comorbid factors including age, location and histologic subtype of the tumor and institutional experience. Surgery followed

by RT with or without chemotherapy is the primary treatment for resectable high-grade sarcomas. The NCCN guidelines recommend various neoadjuvant approaches including preoperative RT or chemotherapy or chemoradiation prior to surgery, followed by postoperative radiation with or without chemotherapy for respectable tumors with acceptable functional outcomes and for potentially resectable tumors with concerns for adverse functional outcomes. Adjuvant chemotherapy alone can be considered in the case of patients who have received preoperative radiation alone. Surgery alone is an option for small tumors that can be resected with wider surgical margins.

Recurrent Disease

The management of recurrent disease or primary presentation with metastases encompasses a heterogeneous group of patients and clinical scenarios. For a patient with a local recurrence, treatment decisions should be made using the same algorithm as for patients with a new primary lesion. .

Surveillance

Surveillance is deemed important to detect recurrences that might still be potentially curable. However, very limited data is available in the literature on effective surveillance strategies. The guidelines outline a prudent follow-up schedule that avoids excessive testing. Higher grade and larger tumors have a higher risk of dissemination; therefore, the surveillance recommendations for patients with these tumors are somewhat more intensive, particularly for the first 3 years after resection. Periodic imaging (MRI, CT, or consider ultrasound) of the primary site should be done based on the estimated risk of loco regional

recurrence. However, in situations where the area is easily followed by physical examination, imaging may not be required. After 10 years, the likelihood of developing a recurrence is small and follow-up should be individualized.

Stage I tumors are routinely followed with H&P every 3 to 6 months for 2 to 3 years and then annually. Baseline imaging should be considered after primary therapy. Chest x-ray should also be considered every 6 to 12 months. For stage II and stage III tumors, H&P and chest imaging (plain radiograph or chest CT) should be done every 3 to 6 months for 2-3 years, then every 6 months for the next 2 years, and then annually. Because these patients' risk never returns to zero, long-term follow-up is indicated, including consideration of MRI or CT scanning.80 Chest imaging (plain radiograph or chest CT) is performed every 3 to 6 months for 5 years and then annually, given the risk of metastatic disease in these high-grade lesions. There has never been a study to prove that the use of more sensitive CT scans in routine surveillance would improve clinical outcomes. According to the reported data from M. D. Anderson Cancer Center, routine use of chest CT adds little clinical benefit, when risk of pulmonary metastases is low.81 However, in certain subsets of patients in whom chest radiographs are difficult to interpret because of anatomic considerations (scarring, emphysema, etc), chest CT surveillance may be indicated.

REHABILITATION AFTER LIMB-SPARING SURGERY

Although limb-sparing surgery can enhance the quality of life it does cause a variety of functional impairments, and creates a need for early intensive rehabilitative intervention.

Rush defined medical rehabilitation as “maximal preservation of physical, psychological, social, occupational, creative and economical function in conjunction to malignant disease and its treatment”.

For many years it has been assumed that investing in extensive rehabilitation efforts for patients with poor prognoses and short life expectancies could not be justified from an economic perspective. Now that cure rates among patients who have undergone Limb Sparing Surgery are 60–80%, this assumption is clearly no longer correct. It is no less important to rehabilitate patients with metastatic disease.

LIMB SPARING SURGERY versus AMPUTATION

Limb Sparing Surgery can result in survival rates and disease-free periods that equal those achieved with amputation. The presumed functional and psychological advantages of Limb Sparing surgery over amputation, however, have yet to be established. Limb Sparing Surgery appears to offer the possibility of better psychological functioning and an intact body image, but it is more complex and demanding than amputation and is associated with more morbidity. The duration of surgery is longer, and infection, pain, and other postoperative complications are more common.

Otis *et al.* compared energy cost during gait in osteosarcoma patients after resection of the distal femur and knee joint and replacement with an endoprosthesis with that of patients who had undergone an above-knee amputation. The former had a lower energy cost during gait than the latter.

Eiser *et al*. noted that one of the disadvantages of Limb Sparing Surgery is that additional hospitalizations may be necessary in the case of complications

It is important to emphasize that, in order to justify Limb Sparing Surgery, the procedure must provide limb function equal or superior to that provided by an external prosthesis after amputation. At the same time the tumor must be resected according to principles of oncologic surgery (i.e. there must be free margins and minimal damage to major neurovascular bundles and muscles). Despite the disadvantages, nearly all patients believe that an attempt to salvage a limb is worth the time and effort.

4. MATERIALS AND METHODS

Patients admitted and undergone limb sparing surgery for extremity soft tissue sarcoma between January 2004 to April 2008 in the Department of Surgical Oncology, Government Royapettah Hospital, Chennai were taken for study.

Data were collected in all patients. Patient's age and sex were noted. Histories like presence of swelling, its duration, presence of pain and its duration, other symptoms and family history were recorded. Previous history of surgery, biopsy if any and treatment were taken.

Physical examination was done to note site, size of swelling and presence or absence of metastases. Previous surgical scar, its length, present status, orientation to longitudinal axis of limb were noted.

All patients were evaluated with X-ray chest and CT Scan local part or MRI of local part. CT Scan chest was done in all cases. Histology was obtained with trucut biopsy. If there was already biopsy, it was reviewed.

Patients with metastatic disease were excluded from study. Suitable patients for limb salvage were undergone surgery. Those patients requiring amputation were excluded. Postoperative complications and its management were observed. Histopathology, grade, and margin status were noted. Histopathology is compared with previous reports. Surgical, functional and oncological outcome are evaluated.

Patients were followed up regularly once a month in first year, every two months in second month, every three months in third year, every 6 months in fourth and fifth year and then annually.

5. OBSERVATION AND ANALYSIS

Musculoskeletal sarcomas consisted of 2.24% of all cancers admitted from January 2004 to April 2008**.** Soft tissue sarcoma represents less than 1% of all adult of all malignancies in various studies but in this series it represented about 1.64%.

Cancers	Number	Percentage
Musculoskeletal sarcomas	292	2.24
Other cancers	12719	97.76
Total	13011	100

Cancers	Number	Percentage
Soft tissue sarcomas	213	1.64
Other cancers	12798	98.34
Total	13011	100

Soft tissue sarcomas consisted of 73% (213 cases) of total 292 cases (bone sarcoma-22%[63] , fibromatosis- 5%[16] of cases] with ratio of soft tissue sarcoma to bone sarcoma 3.5:1 compared to 3:1 in the literature.

MUSCULOSKETAL SARCOMAS	NUMBER	%

SOFT TISSUE SARCOMAS	213	73
FIBROMATOSIS	16	5
BONE SARCOMAS	63	22
TOTAL	292	100

Extremity soft tissue sarcomas consisted of 57% (122 cases) of total 213 soft tissue sarcoma cases (0ther sites-43% [91] of cases).

Site distribution of soft tissue sarcoma	Frequency	Percentage
Extremity	122	57
Other sites	91	43
Total	213	100

Admission in **Memorial Sloan-Kettering Cancer Center** consisted of 41% of extremity sarcomas and 59% of other site soft tissue sarcomas and in this study, it is 57% and 43% respectively.

Centre	Extremity	Other sites
Memorial Sloan-Kettering Cancer Centre	41%	59%
MD Anderson cancer centre	59%	41%
Government Royapettah hospital	**57%**	**43%**

In extremity soft tissue sarcomas, 73% (89 cases) had localized disease, and 27% (33 cases) had metastatic disease on presentation. **Temple LK et al.** reported 20% metastatic disease at presentation.

Extremity-presentation	Frequency	Percentage
Metastatic	33	27
Localized	89	73
Total	122	100

Metastatic disease	Percentage
Temple et al	20%
Government Royapettah Hospital	**27%**

Out of 89 cases of localized extremity soft tissue sarcomas, 72 (81%) cases were identified as fit for limb sparing surgery. Remaining 17 (19%) cases were not suitable for limb sparing surgery and needed amputation.

Localized soft tissue sarcoma- fitness for limb sparing surgery	Frequency	Percentage
Fit	**72**	**81**
NOT FIT, needed amputation	**17**	**19**
Total	**89**	**100**

The most extensive resection is clearly amputation. This should be only rarely indicated in soft tissue sarcoma because limb-sparing operations are possible in at least 95% of patients. Experience over the last 25 years at **MSKCC** indicates that the amputation rate, which was 50% in the late 1960s, is now less than 5%. Amputation should be reserved for tumors that cannot be resected by any other means, without evidence of metastatic disease and the potential for good long-term functional rehabilitation. This usually includes patients with large, low-grade tumors with considerable cosmetic and functional deformity, who can be rendered symptom free by a major amputation. In this study, 19% of patients with localized soft tissue sarcoma required amputation. This high rate of amputation is due to large tumor size and late presentation of our patients.

Centre	Limb sparing surgery	Amputations
Memorial Sloan-Kettering Cancer Centre	>95%	<5%
Watson DI et al	92.5%	7.5%
Government Royapettah hospital	**81%**	**19%**

In this series of 72 patients, only 58(81%) patients were undergone limb sparing surgery and remaining 14(19%) patients refused further treatment. So, these 58 patients were taken for further study.

Course of patients fit for Limb sparing surgery	Frequency	Percentage
Limb sparing surgery done	58	81

Refused surgery	14	19
Total	72	100

In this series of 58 patients, male patients were 35(60%) and female were 23 (40%) with male to female ratio of 1.5: 1. and Ratio is 4:1 in the literature.

SEX	Frequency	Percentage
Male	35	60
Female	23	40
Total	58	100

Patient's age ranges from 16 to 75. Median age of patients is 45, average age is 46. Two third of the patients are in the age group of 31-60.

AGE	Frequency	Percentage
<30 years	12	21
31-60 years	**38**	**66**
>61 years	8	13
Total	58	100

All patients are presented with swelling with varying duration. 52% (30 cases) of patients presented with pain and 3.5% (2) cases with other symptoms.

Symptoms	Frequency	Percentage

Swelling	All	100%
Pain	30	52%
Other symptoms	2	3.5

In a study by Lawrence et al, 33% of patients complained of pain at the time of diagnosis. In this study, pain is the symptom that draws the patient to seek medical attention. Any soft tissue mass in an adult that is symptomatic or enlarging, any mass that is larger than 5 cm, or any new mass that persists beyond 4 weeks is sampled

Approximately 10% soft tissue sarcoma patients have positive family history of cancer as observed in this study as well as in the literature. Approximately 5% of patients with NF develop malignant peripheral nerve sheath tumors (MPNSTs) (Sorensen S et al). In this study one out of 12 patients with malignant peripheral nerve sheath tumors had neurofibromatosis.

39 (67%)cases were occurred in lower extremity and 19(33) cases in upper extremity with ratio of 2:1 comparable to Memorial Sloan-Kettering Cancer Center's experience in which it is 71% and 29% respectively with ratio of 2.5:1.

SITE	Frequency	Percentage
Lower Extremity	39	67
Upper Extremity	19	33
TOTAL	**58**	**100**

Centre	Upper Extremity	Lower Extremity

Memorial Sloan-Kettering Cancer Center	29%	71%
Government Royapettah Hospital	**33%**	**67%**

SITE	Frequency	Percentage
Gluteal region	4	7%
Thigh	**30**	**52%**
Leg	4	7%
Ankle	1	1.7%
Foot	-	-
Shoulder	**6**	**10%**
Arm	**6**	**10%**
Elbow	1	1.7%
Forearm	5	8.9%
Hands	1	1.7%
TOTAL	**58**	**100%**

Commonest site of extremity soft tissue sarcoma in all series is thigh. In this study also commonest site is thigh (30 **(52%)** cases) followed by shoulder and arm (6 cases **(10%)** each)

24(**41%**) patients have primary tumors, 18(**31%**) are recurrent tumors and 16(**28%**) are residual tumors. Residual tumors are those presented after excision biopsy or marginal excision.

Status of primary tumor	Frequency	Percentage
Primary	24	41

Recurrent	18	31
Residue	16	28
Total	58	100

Stage	Frequency	Percentage
1A	5	9
1B	**29**	**50**
2A	2	3
2B	-	-
3	**18**	**31**
4	1	2
No stage	3	5
Total	58	100

On admission 29(50%) cases are in stage 1B, followed by 18(31%) cases in stage 3. In three cases, stage was not assigned since they are dermatofibrosarcoma protuberance (2 cases) and angiosarcoma(one case).

Out of 55 cases, 46(84%) cases have T2b disease, 8 (14%) cases have T1b disease and T1a one case. 48 (83%) out of 58 cases had swelling more than 5 cm in size. So, any soft tissue mass that is >5cm in size should be investigated definitively **(Brennan MF et al).**

T stage	Frequency	Percentage
T1a	1	2
T1b	8	14

T2a	-	-
T2b	**46**	**84**
Total	55	100

Liposarcoma is the commonest histology with 22% (13 cases). Liposarcoma, malignant peripheral nerve sheath tumor and malignant fibrous histiocytoma occur in almost equal frequency , comprising about 62% of cases.

Histopathology is dependent on the anatomic site. The common subtypes in the extremity are liposarcoma and malignant fibrous histiocytoma **(Fletcher CD)**. In this study, Liposarcoma is the commonest histology followed by malignant peripheral nerve sheath tumor and malignant fibrous histiocytoma.

Histology	Frequency	Percentage
Liposarcoma	**13**	**22**
Malignant peripheral nerve sheath tumor	**12**	**21**
Malignant fibrous histiocytoma	**11**	**19**
Synovial sarcoma	6	10.5
Spindle cell sarcoma	6	10.5
Others	10	17
Total	58	100

Margin was free in 83% (48 cases), close in 7% (9 cases) and not applicable in 10% (6 cases) since there is no residual tumor.

Margin status	Frequency	Percentage
Free	**48**	**83**
Close	4	7
Positive	0	0
Not applicable	6	10
Total	58	100

As might be expected, there can be considerable disagreement among pathologists regarding the specific histologic diagnosis in individual cases.

In this study in comparison with preoperative histology there is 64% of concordance with 26% of discordance rate.

	Frequency	Percentage
Histology concordance	37	64
Histology discordance	**15**	**26**
Not available	6	10
Total	58	100

When pathologic material from 424 patients who entered into Eastern Cooperative Oncology Group (ECOG) sarcoma trials was reviewed by a panel of expert pathologists, 10% of cases were rejected as not being sarcoma, and for 14% of the remaining cases there was disagreement with respect to the histologic subtype.

In the Scandinavian Sarcoma Group experience, the specific histologic diagnosis was disputed in 20% of cases.[37] With increasing familiarity with the immunohistochemical and genetic studies needed to diagnose soft tissue sarcoma, the rate of this discordance may be decreasing.

Study	Discordance Rate
ECOG sarcoma trials	14%
Scandinavian Sarcoma Group	20%
Government Royapettah Hospital	26%

Wide mono bloc excision was done in 47 (81%) cases, compartmental excision in 10(17%) cases and marginal excision in one case.

Type of surgery	Frequency	Percentage
Wide mono bloc excision	**47**	**81**
Compartmental excision	10	17
Marginal excision	1	2
Total	**58**	**100**

In 7 (12%) cases vascular resection was done. But only in 4 (7%) cases vascular reconstruction was done**.**

Vessel Resected	Frequency	Percentage
Femoral Artery & Vein	3	43%
Deep femoral Artery & Femoral Vein	1	14%
Deep femoral Artery	2	29%
Ulnar artery	1	14%

TOTAL	**7**	**100%**

Type of vascular reconstruction	**Frequency**	**Percentage**
Superficial femoral Artery & Vein	2	29%
Superficial femoral artery only	1	14%
Superficial femoral Vein only	1	14%
No reconstruction	3	43%
Total	**7**	100%

35 (60%) patients needed some form of reconstruction. 18 (31%) patients needed flap reconstruction, 5 skin graft, 4 vascular reconstruction, 4 tendon transfers, and flap and skin graft, flap and plate, flap and mesh, mesh one each.

Types of Reconstruction	**Frequency**	**Percentage**
Flaps	**18**	**31%**
SSG	5	8.6%
Vascular	4	6.8%
Tendon transfer	4	6.8%
Flap & SSG	1	1.7%
Flap & Plate	1	1.7%
Flap & Mesh	1	1.7%
Mesh	1	1.7%
Total	**35**	**60%**

Latissmus dorsi flap and local transposition flap are common flaps used(in 6 cases each). Gastrocnemius flap is used in 3 cases and reverse sural artery flap in 2 cases. Other flaps are used in 4 cases.

Types of flaps used	Frequency	Percentage
Latissmus dorsi	6	10.3%
Transposition flap	6	10.3%
Gastrocnemius	3	5.2%
Reverse sural artery	2	3.4%
Pectoralis Major Myo Cutaneous	1	1.7%
Posterior thigh	1	1.7%
Abdominal	1	1.7%
Tensor fascia lata	1	1.7%
Total	21	36%

So in situations of primary or recurrent tumors in which skin is involved or in which the tumor is so extensive that skin is involved, then consideration of free flap or rotational flap closure becomes important, particularly in those patients who are candidates for subsequent adjuvant radiation therapy.

Overall complications rate is 42%. Most common complication is marginal flap necrosis followed by lower limb edema. Other complications are Infection and wound gaping (2 cases), infection (one case), wound gaping (one case) and femoral artery blow out (one case).

Complications	Frequency	Percentage
Marginal flap necrosis	**12**	**21**
Edema leg	5	9
Seroma	2	3.4
Infection and wound gaping	2	3.4
Infection	1	1.7
Wound gaping	1	1.7
Femoral artery blow out	1	1.7
Total complications	**24**	**42**
No complications	**34**	**58**
Total	**58**	**100**

79% (19 cases) were needed some form of secondary intervention to manage the complications.

Management of complications	Frequency	Percentage
Wound debridement	6	25%
Secondary suturing	6	25%
Skin graft	**5**	**21%**

Flap reconstruction	**2**	**8%**
Conservative	5	21%
Total	**24**	**100%**

In this study, 33% of patients developed postoperative complications requiring some form of intervention compared to 16% of complications reported by **Yang JC et al** in a randomized prospective study. But no patients required amputations in this study as reported by **Yang JC et al** (2% amputation rate).

Post operative complications	Yang JC et al	**Government Royapettah Hospital**
Requiring intervention	16%	33%
Requiring amputation	2%	Nil

Totally 7(12%) cases were presented with history of previous radiotherapy or chemotherapy or both. Totally 5(8.5%) cases had radiotherapy, so adjuvant radiotherapy is not possible in these cases.

	Frequency	Percentage
Previous H/O radiation	2	3.5%
Previous H/O radiation and chemotherapy	3	5%
Chemotherapy	2	3.5%
Total	7	12%

32 cases have received adjuvant therapy. Out of these, one had preoperative radiotherapy, 23 cases had postoperative adjuvant radiotherapy, 7 cases had both chemotherapy and radiotherapy, and one had chemotherapy.

Additional treatment	Frequency	Percentage
Preoperative radiotherapy	1	1.7%
Postoperative radiotherapy	**23**	**39.6%**
Postoperative radiotherapy and chemotherapy	**7**	**12.1%**
Postoperative chemotherapy	1	1.7%
Total	**32**	**55.1%**

The goals of adjuvant radiotherapy in the management of soft tissue sarcoma are to enhance local control, preserve function, and achieve acceptable cosmesis by contributing to tissue preservation. The evidence for adjunctive radiation therapy in patients eligible for conservative surgical resection comes from two randomized trials and a number of large single-institution reports.

In one of these randomized trials, conducted by the National Cancer Institute, 91 patients with high-grade extremity tumors were treated with limb-sparing surgery followed by chemotherapy alone or radiation therapy plus adjuvant chemotherapy. A second group of 50 patients with low-grade tumors were treated with resection alone versus resection with radiation therapy. The 10-year local control rate for all patients receiving radiation therapy was 98% compared with 70% for those not receiving radiation therapy.

In the second randomized trial, which was performed at Memorial Sloan-Kettering Cancer Center, 164 patients were randomized to observation or brachytherapy following conservative surgery. The 5-year local control rate for patients with high-grade tumors was 66% in the observation group and 89% in the group treated with brachytherapy. There was no significant difference between the groups of patients with low-grade tumors.

6 patients had disease recurrence. 4 patients had local recurrence. All but one local recurrence were successfully salvaged with limb sparing surgery. One patient had both local and distant recurrence at two years and died after 6 months (survival 30 months). Another patient recurred distantly at 30 months, now alive with disease (survival 37 months)

Recurrence pattern	Frequency	Percentage
Local	4	7%
Local and distant	1	1.7%
Distant	1	1.7%
Total	6	10.4%

Follow up ranges from 1 month to 51 months. One patient had more than 4 years follow up, 8 patients had more than 3 years follow up, 22 patients had more than 2 years follow up, 8 patients had more than 1 year follow up and 19 had less than one year follow up.

Duration follow up	No.of patients	Percentage
More than 4 years	1	1.8%
More than 3 years	8	13.8%
More than 2 years	22	37.8%

More than 1 year	8	13.8%
Less than 1 year	19	32.8%
Total	58	100%

84.5% (49 cases) are disease free at closure of this study. 3.4% (2 cases) are alive with disease. 1.7% (0ne case) was died. 10.4% (6 cases) are lost follow up.

Present status	No. of patients	Percentage
Disease free	49	84.5%
Alive with disease	2	3.4%
Dead	1	1.7%
Lost follow up	6	10.4%
Total	58	100%

70.8%(41 cases) and 22.4% (13 cases)of patients had good and fair functional outcome. Remaining 6.8% (4 cases, 2 cases each) had excellent and poor functional result**.**

Outcome	Frequency	Percentage
Excellent	2	3.4%
Good	**41**	**70.8%**
Fair	**13**	**22.4%**
Poor	2	3.4%

Total	58	100%

6. Conclusions

Soft tissue sarcomas are the most frequent sarcomas. They are a rare and heterogeneous group of tumors representing 1.64% of all adult malignancies in this series.

They are a disease of adulthood, occurring most commonly in persons between 30 and 60 years of age. Incidence in male is lower (male: female ratio – 1.5:1) in this series than reported in other series (ratio 4:1)

In this study, 81% of patients are suitable for limb sparing surgery and 19% of patients required amputation. This somewhat higher rate of amputation compared to international series is due to large tumor size and late presentation of our patients.

In this study, pain is the symptom that draws the patient to seek medical attention and most of the swellings are more than 5 cm in size. So, any soft tissue mass in an adult that is symptomatic or enlarging, any mass that is larger than 5 cm or any new mass that persists beyond 4 weeks is should be considered as soft tissue sarcoma and investigated definitively.

Evaluation for metastatic disease in the lungs should be done once a soft tissue sarcoma is diagnosed since one third of patients are metastatic at presentation in this study comparable to other studies.

84% of patients had T2b tumor that is deep tumor with size of more than 5 cm. Liposarcoma is the commonest histology comparable to other studies. In comparison with preoperative histology, there is 26% of discordance rate comparable to international series.

With increasing familiarity with the immunohistochemical and genetic studies needed to diagnose soft tissue sarcoma, the rate of this discordance may decrease.

Wide local excision is the most common surgery (81%) done. In soft tissue sarcomas of extremity involving major vessels, vascular resection and reconstruction can be done successfully to salvage the limb.

In situations of primary or recurrent tumors in which skin is involved or in which the tumor is so extensive that skin is involved, then consideration of free flap or rotational flap closure becomes important, particularly in those patients who are candidates for subsequent adjuvant radiation therapy.

We depend on pedicled flap or local transposition flap for reconstruction. With use of free flaps in future, limb salvage rate can be increased with reduction in the rate of complications.

Even though limb sparing surgery has considerable percentage of complications than other studies, it is done without complication of amputation.

More than 70% of patients achieved good functional outcome following limb sparing surgery in this study. Limb sparing surgery can result in survival rates and disease-free periods that equal those achieved with amputation. The presumed functional and psychological advantages of Limb sparing surgery over amputation, however, have yet to be established. Limb sparing surgery appears to offer the possibility of better psychological functioning and an intact body image.

Limb-sparing surgery is now the standard of care for bone and soft tissue sarcomas of the extremities and is performed in approximately 90% of all cases. All patients must be considered and evaluated for limb-sparing surgery, and the decision to proceed with an amputation should be made on a case-by-case basis. Such decisions are based on local anatomic considerations, tumor grade and stage, and consideration of the functional and psychological impact of the procedure.

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PROFORMA

STUDY ON LIMB SPARING SURGERY IN EXTREMITY SOFT TISSUE SARCOMAS

NAME : **OCCUPATION :** **DOA:**
AGE/SEX : **IP/CD NO. :** **DOS:**
ADDRESS : **PHONE NO. :** **DOD:**

DIAGNOSIS	
TNM STAGING	
STAGE GROUPING	

COMPLAINTS

SWELLING **:** YES/NO
DURATION :
PAIN **:** YES/NO
DURATION :
INSTABILITY OF ARM **:** YES/NO
DECREASED MOBILITY OF ARM **:** YES/NO
PREVIOUS BIOPSY **:** YES/NO
TYPE OF BIOPSY **:** FNAC
: CORE NEEDLE BIOPSY
: INCISIONAL BIOPSY
: EXCISIONAL BIOPSY
BIOPSY PERFORMED BY : SURGICAL ONCOLOGIST
: GENERAL SURGEON
: ORTHOPAEDIC SURGEON
: OTHERS
FAMILY H/O CANCER **:** YES/NO
WHO AFFECTED : 1^{ST} /2^{ND} /3^{RD} DEGREE RELATIVE
BY WHICH MALIGNANCY :
MULTIPLE RELATIVES AFFECTED :
PREVIOUS H/O MALIGNANCY : YES/NO
TYPE OF MALIGNANCY : CARCINOMA / SARCOMA
HISTOLOGY :
H/O PREVIOUS TREATMENT : SURGERY
: CHEMOTHERAPY
: RADIOTHERAPY
: OTHERS
H/O IRRADIATION : YES/ NO DATE:

PHYSICAL EXAMINATION

PERFORMANCE STATUS **:**
PREVIOUS BIOPSY SCAR LENGTH **:** CM
: TRANSVERSE / LONGITUDINAL /OBLIQUE
HEALING STATUS **:** HEALED / HEALING / INFECTED
HEALED BY WHAT INTENTION **:** PRIMARY / SECONDARY

EXAMINATION OF SWELLING

SITE

UPPER LIMB **:** RIGHT / LEFT
: ARM / ELBOW / FOREARM / HAND
: SHOULDER GIRDLE

COMPARTMENT INVOLVED **:**

LOWER LIMB **:** RIGHT / LEFT
: THIGH/POPLITEAL FOSSA/LEG/FOOT
: GLUTEAL REGION

COMPARTMENT INVOLVED **:**

PLANE **:** SUPERFICIAL / DEEP
: INVOLVIG FASCIA / BONE

SIZE : CM, <5 / 5-10 / >10 CM

SKIN INVOLVEMENT **:** YES / NO

VASCULAR INVOLVEMENT **:** YES / NO

VESSEL AFFECTED **:**

NERVE INVOLVEMENT **:** YES / NO

NERVE AFFECTED **:**

EXTENT **:**

REGIONAL LYMPH NODES **:** YES / NO

DISTANT METASTASES **:** YES / NO

SITE OF DISTANT METASTASES **:**

JOINT MOVEMENT AFFECTED **:** YES / NO

WHICH JOINT INVOLVED **:**

INVESTIGATIONS

BIOPSY **:** FNAC / CORE NEEDLE BIOPSY
: INCISION BIOPSY / EXCIONAL BIOPSY

HISTOLOGY **:**

GRADE **:**

IMMUNO HISTOCHEMISTRY **:**

XRAY CHEST **:** NORMAL / METASTASES

METASTASES IN WHICH LUNG **:** RIGHT / LEFT / BILATERAL

NUMBER OF METASTASES :

CT SCAN CHEST : NORMAL / METASTASES

METASTASES IN WHICH LUNG **:** RIGHT / LEFT / BILATERAL

NUMBER OF METASTASES :

CT SCAN LOCAL PART **:** SUPERFICIAL / DEEP
: INVOLVING FASCIA / BONE

NERVE : NOT AFFECTED / DISPLACED / INVOLVED

NERVE AFFECTED :

VESSELS : NOT AFFECTED / DISPLACED / INVOLVED

VESSEL AFFECTED :

NECROSIS : YES / NO

HEMORRHAGE : YES / NO

CONTRAST ENHANCEMENT : YES / NO

MRI LOCAL PART :

TREATMENT

RESECTION

EXTENT OF RESECTION **:** WIDE MONOBLOC RESECTION
: COMPARTMENTAL RESECTION
: MARGINAL EXCISION
VASCULAR RESECTION **:** YES / NO
VESSEL RESECTED **:** ARTERY / VEIN / BOTH
PARTS RESECTED **:**

RECONSTRUCTION

SKIN **:** PRIMARY CLOSURE / FLAP
SOFT TISSUE **:** PRIMARY CLOSURE / FLAP
NAME OF FLAP USED **:**
VASCULAR RECONSTRUCTION **:** YES / NO
VESSEL USED **:**

POSTOPERATIVE COMPLICATIONS

WOUND INFECTION **:** YES / NO
FLAP NECROSIS **:** NO / MARGINAL / TOTAL
WOUND GAPING **:** YES / NO
SECOND SURGERY **:** YES / NO
TYPE OF SECOND SURGERY **:** WOUND DEBRIDEMENT / SSG
: SECONDARY SUTURING / FLAP COVER
: AMPUTATION

HOSPITAL STAY

NO OF DAYS **: PREOPERATIVE** **:** DAYS
: POSTOPERATIVE : DAYS

POST-OPERATIVE HISTOPATHOLOGICAL EXAMINATION

NUMBER **:**
HISTOLOGY **:**
GRADE **:** LOW / HIGH
MARGIN **:** NEGATIVE / POSITIVE / CLOSE
: CM

ADJUVANT THERAPY **:** CHEMOTHERAPY / RT / BOTH

CHEMOTHERAPY - DRUGS **:**
NO OF CYCLES **:**

RADIOTHERAPY

MODE **:** EBRT / BRACHYTHERAPY / BOTH

TOTAL DOSE :
NUMBER OF FRACTIONS :
DOSE PER FRACTION :
TREATMENT BREAK : YES / NO
CUASE OF TREATMENT BREAK :
COMPLICATIONS :

REHABILITATION

REST IN SPLINT : YES / NO
DURATION IN SPLINT : DAYS
TIME OF RESTORATION OF MOVEMENT :
TIME OF RESTORATION OF MOBILITY :

FUNCTION OF LIMB

USING THE LIMB : YES / NO
PAIN : YES / NO
MOVEMENT OF LIMB : ABSENT / PRESENT
: ACTIVE / PASSIVE
: PAINFUL / PAINLESS
RANGE OF MOVEMENTS :

FOLLOW UP

PARAMETERS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
DATE																				
DISEASE FREE YES/NO																				
RECURRENCE YES/ NO																				
TIME OF RECURRENCE																				
SITE OF RECURRENCE																				
LOCAL																				
REGIONAL																				
DISTANT																				
SITE OF DISTANT RECURRENCE																				

SALVAGE OF RECURRENCE : YES / NO
MODE OF SALVAGE :

MASTER CHART

	Age/ Sex	C.D. No	Site	Swelling duration	Pain / duration	Other symptoms	Family history	Previous biopsy Y/N type	Biopsy/ surgery done by	Prior surgery Yes/No Duration	Prior RT Chemo	Scar status	Size/ Deep/ superficial	Primary/ Recurrent/ residual	biopsy
n	62/M	135/04	Thigh RT	3 months	Yes, 1 month	-	-	-	General Surgeon	Yes, 1 year	-	15 cm. longitudinal	10cm deep	Recurrent	-
	53/M	734/04	Arm LT	2 months	1 month	Fungation, bleeding	-	-	General Surgeon	Yes 4 years	-	-	12cm, Deep fungation	Recurrent	-
	16/F	778/04	Thigh RT	5 months	-	-	-	Yes excision	General Surgeon	Yes, 1 month	-	20 cm. longitudinal	15cm, Deep	Residue	-
	50/M	721/04	Arm RT	3 months	-	-	-	-	General Surgeon	Yes, 9 months	-	15 cm. longitudinal	8cm, Deep	Recurrent	-
	55/F	939/04	Thigh LT	6 months	-	-	-	-	General Surgeon	Yes 20 days	-	12 cm. longitudinal	8cm, Deep	Residue	-
	58/M	1382/04	Thigh RT	4 months	Yes, 4 months	-	-	Yes excision	General Surgeon	Yes 20 days	-	6 cm longitudinal	12cm, Deep	Residue	-
	64/M	446/05	Thigh RT	5 months	yes , 4 months	-	-	-	-	-	-	-	7cm, deep	Primary	Trucut
o	60/M	1445/05	Thigh LT	One year	-	Fungation	NF+	Yes, incision	General Surgeon	--	-	5 cm. Longitudinal	25cm, Deep	Primary	-
	19/F	569/05	Thigh LT	6 months	-	Fungation	-	-	General Surgeon	4 years	RT	-	6cm Deep	Recurrent	-
	47/F	1114/05	Thigh LT	2 months	2 months	-	-	-	-	-	-	-	15cm Deep	Primary	Trucut
m	60/M	719/05	Thigh LT	4 months	2 months	-	-	-	General Surgeon	Yes, 1.5 years	-	6 cm Longitudinal	8cm Deep	Recurrent	-
	Age/ Sex	**C.D. No**	**Site**	**Swelling duration**	**Pain / duration**	**Other symptoms**	**Family history**	**Previous biopsy Y/N type**	**Biopsy/ surgery done by**	**Prior surgery Yes/No Duration**	**Prior RT Chemo**	**Scar status**	**Size/ Deep/ superficial**	**Primary/ Recurrent/ residual**	**biopsy**
	19/F	724/05	Forearm RT	1 month	1 month	-	Yes, father	-	General Surgeon	Yes , 3 times	-	6 cm Longitudinal	5cm, Deep	Recurrent	-
	45/M	788/05	Thigh LT	2 months	-	-	-	-	General Surgeon	Yes, 6 months	-	5 cm Longitudinal	15 cm, Deep	Recurrent	-
n	40/F	917/05	Thigh LT	3 months	1 month	-	-	Yes, excision	General Surgeon	Yes, 2 months	-	6cm Oblique	4 cm deep	Residue	-
al	51/F	959/05	Gluteal region LT	1 month	-	-	-	-	General Surgeon	Yes , 3 times	-	15 cm Oblique	10 cm deep	Recurrent	-
	45/M	1023/05	Thigh RT	2 months	1 month	-	-	Yes, excision	General Surgeon	Yes, 1 month	-	8 cm Longitudinal	8 cm deep	Residual	-
	37/M	1234/05	Elbow left	6 months	3 months	Difficulty In using	-	-	-	-	-	-	15 Deep	Primary	Trucut

						elbow									
	19/F	1395/05	Thigh LT	One year	4 months	-	-	Yes, incision	General Surgeon	Yes, 1 month	-	6 cm Longitudinal	15 cm deep	Primary	-
	20/F	22/06	Thigh LT	5 month	-	-	-	Yes, excision	General Surgeon	Yes, 2 months	Chemo Therapy	7 cm Longitudinal	6 cm deep	Residual	-
	35/F	130/06	Arm LT	4 months	-	-	-	Yes, excision	General Surgeon	Yes, One year	-	5 cm Oblique	8 cm deep	Recurrent	-
	Age/ Sex	**C.D. No**	**Site**	**Swelling duration**	**Pain / duration**	**Other symptoms**	**Family history**	**Previous biopsy Y/N type**	**Biopsy/ surgery done by**	**Prior surgery Yes/No Duration**	**Prior RT Chemo**	**Scar status**	**Size/ Deep/ superficial**	**Primary/ Recurrent/ residual**	**biopsy**
y	63/F	483/06	Thigh RT	2 month	-	-	-	-	-	-	-	-	8cn Deep	Primary	Trucut
an	63/M	97/06	Thigh RT	0ne Year	6 months	-	-	-	-	-	Chemo Therapy	-	14cm Deep	Primary	Trucut
	45/M	426/99	Thigh LT	3 months	-	-	-	-	-	-	-	-	12cm Deep	3rd primary	Trucut
	42/M	354/06	Leg LT	5 years	-	-	-	Yes Excision	General surgeon	Yes, 1 month	-	6cm Oblique	5Cm Deep	Residue	-
	45/F	543/06	Gluteal RT	1.5 years	4 months	Bleeding	-	Incision	General surgeon	-	-	-	12cm superficial	Primary	-
	32/M	777/06	Thigh LT	3 months	1 month	-	-	-	Plastic surgeon	Yes 3 times	-	Skin involved	10cm Deep	Recurrent	Trucut
	35/M	1291/06	Leg LT	3 months	2 months	-	-	Yes Excision	General surgeon	Yes, 8 months	-	Skin involved	8cm Deep	Recurrent	-
ar	35/M	1328/06	Thigh LT	1 year	-	-	-	-	-	-	-	-	15cm deep	Primary	Trucut
	34/M	1453/06	Thigh LT	1 month	-	-	-	-	-	-	-	-	7 cm deep	Primary	Trucut
n	23/M	1533/06	Forearm RT	2 months	2 months	-	-	Yes Excision	General surgeon	Yes, 4 months	-	6 cm longitudinal	4cm deep	Residue	-
	39/M	336/02	Leg LT	2 years	2months	-	-	-	Surgical Oncologist	3 times, 1997	RT	Skin involved	8cm Deep	Recurrent	-
	55/F	16/07	Thigh LT	20 days	-	-	-	-	-	-	-	-	13cm Deep	Primary	Tr ucut
	Age/ Sex	**C.D. No**	**Site**	**Swelling duration**	**Pain / duration**	**Other symptoms**	**Family history**	**Previous biopsy Y/N type**	**Biopsy/ surgery done by**	**Prior surgery Yes/No Duration**	**Prior RT Chemo**	**Scar status**	**Size/ Deep/ superficial**	**Primary/ Recurrent/ residual**	**biopsy**
	29/M	278/07	Thigh RT	2 months	-	-	Yes, mother	-	Surgical Oncologist	Yes, 8 months	Chemo RT	15cm -longitudinal,6cm-transverse	4cm Deep	Recurrent	-
	40/F	609/07	Hand	20 years	1 month	-	-	-	-	-	-	-	2cm	Primary	-

			LT										superficial		
	53/M	432/07	Leg RT	4 months	-	-	-	Yes Excision	General surgeon	Yes, 2 months	-	10 cm Transverse	7cm deep	Residue	-
	57/M	202/07	Thigh RT	2 months	-	-	-	FNAC	General surgeon	-	-	-	18cm Deep	Primary	-
	24/M	413/07	Shoulder LT	2 months	-	Fungation	-	-	General surgeon	Yes, 3 times	Chemo RT	Fungation	12cm, Deep	Recurrent	-
	52/F	620/07 ?626/07	Thigh LT	1.5 year	-	-	-	-	-	-	-	-	15cm Deep	Primary	Trucut
	36/0M	775/07	Foot RT	3 months	2months	-	-	-	General surgeon	1 year	Chemo RT	Fungation	6cm Deep	Recurrent	-
	76/M	867/07	Thigh LT	3 months	1 month	-	Yes	-	-	-	-	-	20cm Deep	Primary	Trucut
	63/M	996/07	Arm RT	6 months	1 month	-	Yes	-	-	-	-	-	12cm Deep	Primary	Trucut
	30/M	982/07	Gluteal region LT	2 months	1 month	-	-	-	General surgeon	Yes, 2 times, 3years	-	Skin graft in situ	Local & nodal recurrence	Recurrent	-
	75/F	998/07	Gluteal RT	1.5 years	-	-	-	-	General surgeon	Yes, 11 years	-	15cm oblique	15cm Deep	Recurrent	Trucut
	Age/ Sex	**C.D. No**	**Site**	**Swelling duration**	**Pain / duration**	**Other symptoms**	**Family history**	**Previous biopsy Y/N Type**	**Biopsy/ surgery done by**	**Prior surgery Yes/No Duration**	**Prior RT Chemo**	**Scar status**	**Size/ Deep/ superficial**	**Primary/ Recurrent/ residual**	**biopsy**
y	55/F	1067/07	Forearm RT	1 year	-	-	-	-	General surgeon	Yes, 5 years	-	15cm -longi tudinal	6cm, deep	Recurrent	Trucut
	20/M	1212/07	Thigh RT	4 years	1 year	-	-	-	-	-	-	-	14cm Deep	Primary	Trucut
y	59/F	1260/07	Arm RT	2 month	-	-	-	Yes Excision	General surgeon	Yes, 4 months	-	6cm oblique	4cm Deep	Residue	-
	47/M	1335/07	Arm LT	6 months	4 months	-	-	-	-	-	-	-	12cm Deep	Primary	Trucut
	39/M	1483/07	Thigh LT	1 year	6 months	-	Yes	Yes, Incision	General surgeon	Yes, 1 month	-	6cm oblique	6cm deep	Residue	-
	23/F	1527/07	Thigh LT	6 months	2 months	-	-	-	-	-	-	-	-	Primary	Trucut
	26/M	1562/07	Shoulder RT	4 months	-	-	-	Yes Excision	General surgeon	Yes, 2 months	-	4CM Transverse	4cm superficial	Residue	-
	38/M	1855/07	Shoulder LT	3 months	-	-	-	Yes Excision	General surgeon	Yes, 2 months	-	5cm Oblique	4cm Deep	Residue	-
y	55/M	1805/07	Shoulder RT	6 months	3 months	-	-	Yes, Incision	General surgeon	Yes, 3 months	-	15cm -longi tudinal	10cm Deep	Primary	Trucut
	53/F	74/08	Thigh RT	2 years	6 months	-	-	Yes, Incision	General surgeon	Yes, 10 days	-	6 cm -longi tudinal infected	20cm Deep	Primary	-

	50/F	175/07	Forearm RT	2 years	1 month																	
	Age/ Sex	**C.D. No**	**Site**	**Swelling duration**	**Pain duration**	**Vascular-/Bone/ nerve /resection Other symptoms**	**Recons truction Skin/soft tissue Family history**	**Vascular/ Bone Recons truction Patient Previous biopsy Y/N Type**	**Complications Plastic surgeon Biopsy/ surgery done by**	**Second surgery Yes, 4 times Prior surgery Yes/No Duration**	**Post op HPE Grade Prior RT Chemo**	**Margin Skin involved Scar status**	**HPE Concordance/ discordance Deep Size/ Deep/ superficial**	**Adjuvant Recurrent Primary/ Recurrent/ residual**	**Post operative function**	**- Recurrence/ site biopsy**
	35/F	257/08	Shoulder LT	1 year	6 months	-	-	Yes Excision	General surgeon	Yes, 2 months	-	6cm Oblique	6cm deep	Residue		-
	67/F	268/08	Forearm RT	5 months	1 month	--	-	FNAC	General surgeon	-	-	-	8cm deep	Primary		Trucut
r	60/M	534/08	Shoulder RT	1 year	2 months	-	-	Yes incision	General surgeon	Yes, 1 month	-	Skin involved	12cm deep	Primary		-
	53/M	542/08	Thigh	2 month	1 month	-	-	Yes Excision	General surgeon	Yes, 5 months	-	12cm -longitudinal	6cm deep	Residue		-

RT-right, LT-left, FNAC- fine needle aspiration cytology, CD NO-cancer department number

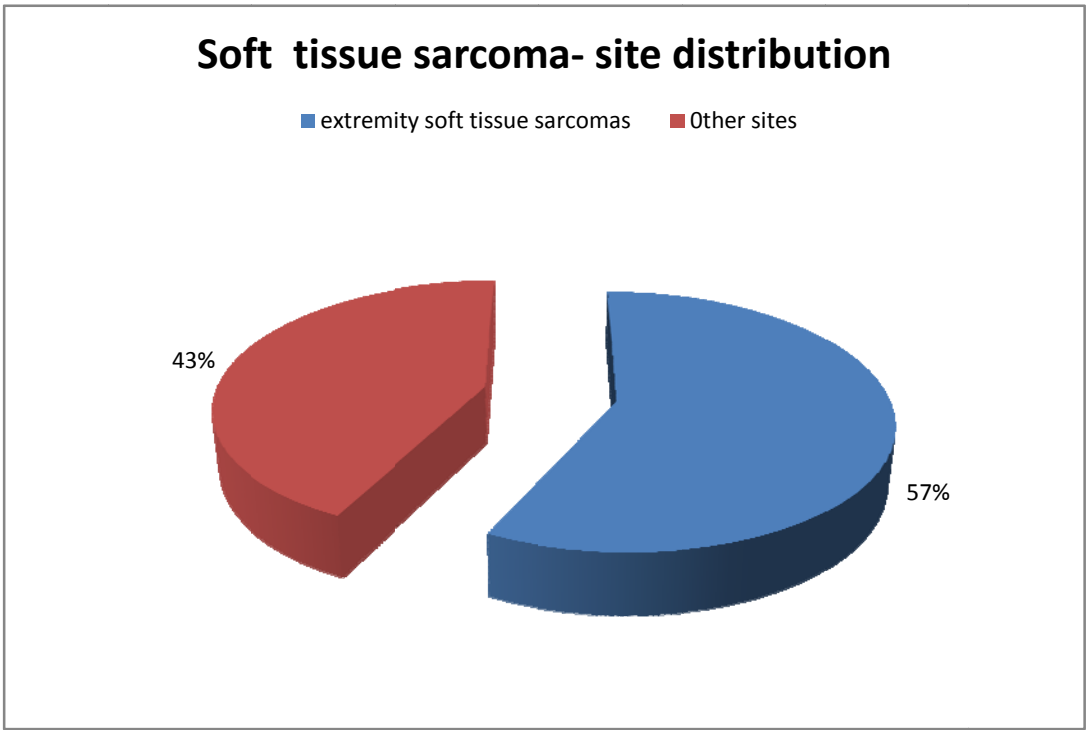
1	Pavadai rajan	Compartmental resection	-	-	-	Edema leg		MFH, Low grade		Concordance	Chemo, RT	Good	-
2	Gangan	Wide Local Excision	-	Latissmus dorsi flap	-	-		MFH, High grade	-VE	Concordance	RT	Good	-
3	Chittu	Wide Local Excision	-	-	-	-		Residual sarcoma	-ve	Discordance	RT	Good	-
4	Musthafa	Wide Local Excision	Musculo cutaneous Nerve	Local transposition flap	-	-		Spindle cell Sarcoma Low grade	-ve	discordance	-	Good	-
5	Regellamma	Compartmental resection	-	-- -	-	-		Liposarcoma Low grade	-ve	Concordance	-	Good	-
6	Mani	Compartmental resection	-	-	-	-		MFH, High grade	-ve	discordance	Chemo, RT	Fair	-
7	kabidoss	Wide Local Excision	-	-	-	-		MFH, High grade	-ve	Concordance	RT	Good	Distant Nodal
8	Samivasa rao	Wide Local Excision	-	Tendon transfer	-	Marginal flap necrosis	Gastroc Nemius flap	MPNST Low grade	-ve	Concordance	RT	Fair	-
9	Lalitha	Wide Local Excision	-	Local transposition flap	-	Marginal flap necrosis	Skin graft	Synovial Sarcoma low Grade	-ve	Concordance	-	Good	-
10	Kanish zainath	Wide Local Excision	-	-	-	Marginal flap necrosis	Wound debride Ment	Liposarcoma high grade	Close	Concordance	RT	Good	Lung bilateral
11	Danihachalam	Wide Local Excision	-	-	-	-		MFH, High grade	-ve	Concordance	RT	Good	-
S. No	**Name**	**Surgery**	**Vascular /Bone/ nerve resection**	**Recons truction Skin/soft tissue**	**Vascular/ Bone Recons truction**	**Compli cations**	**Second surgery**	**Post op HPE Grade**	**Mar gin**	**HPE Concor dance/ discordance**	**Adju vant**	**Post operative function**	**Recu rrence/ site**
12	Kokila	Compartmental resection	Ulnar artery	-	-	-	-	MPNST Low grade	-ve	Concordance	RT	Fair	-
13	Murugesan	Wide Local Excision	-	Tensor fascia lata	-	-	-	RMS High grade	-ve	Concordance	Chemo, RT	Good	-
14	Bee bee john	Wide Local Excision	-	-	-	-	-	No residual Tumor	-	-	-	Good	-
15	Govindammal	Wide Local Excision	-	Local transposition flap	-	Marginal flap necrosis	Skin Graft	Spindle cell Sarcoma Low grade	Clo Se	Concordance	-	Good	-
16	Anjalaiyan	Adductor Compartmental excision	-	-	-	-	-	No residual Tumor	-	-	-	Good	-
17	Puru sothaman	Wide Local Excision	-	Latissmus dorsi flap	-	-	-	Synovial Sarcoma	Clo Se	Concordance	Chemo, RT	Fair	-
18	Ranjana	Wide Local Excision	YES, Artery &		Artery-long saphenous	Wound gaping	Secon dary	Synovial Sarcoma	-ve	Concordance	Chemo, RT	Good	-

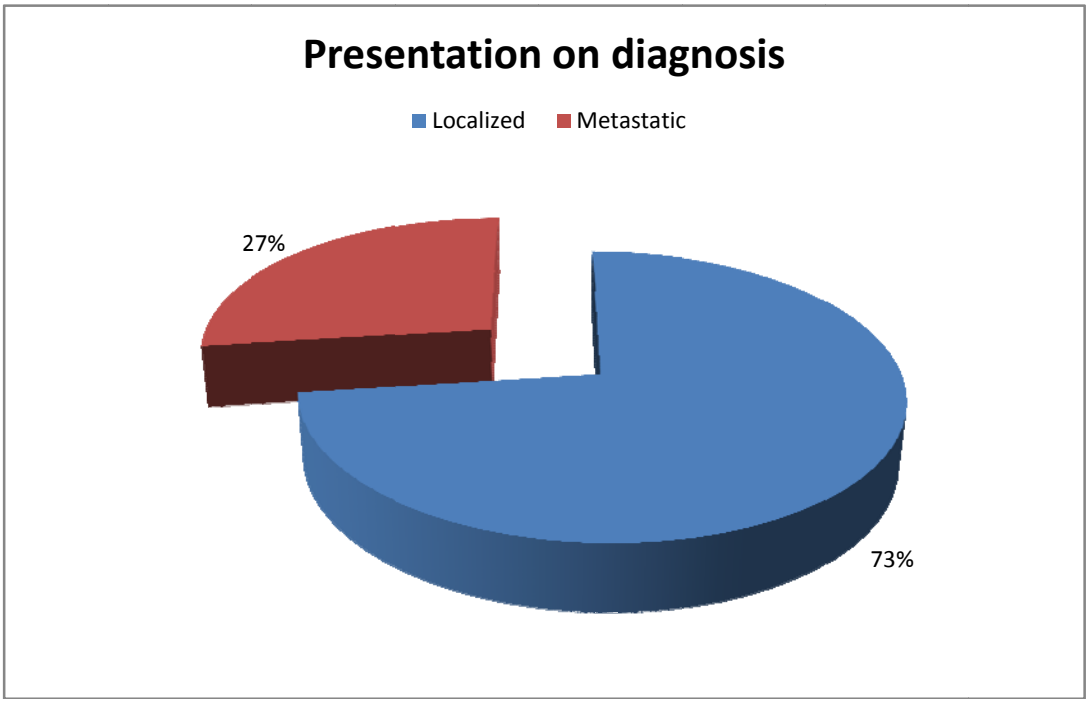
			vein		vein		suturing	High grade					
19	Kavitha	Wide Local Excision	-	-	-	-	-	No residual Tumor	-	-	Chemo,	Good	-
20	Jaya	Wide Local Excision & axillary node dissection	-	Trans Position flap	-	-	-	MPNST Low grade	-ve	Concordance	RT	Fair	Local
S. No	**Name**	**Surgery**	**Vascular /Bone/ nerve resection**	**Recons truction Skin/soft tissue**	**Vascular/ Bone Recons truction**	**Compli Cations**	**Second surgery**	**Post op HPE Grade**	**Mar gin**	**HPE Concor dance/ discordance**	**Adju vant**	**Post operative function**	**Recu rrence/ site**
21	Padmavathy	Wide Local Excision	-	Trans Position flap	-	-	-	RMS High grade	-ve	Concordance	RT	Good	-
22	Chandrahasan	Marginal Excision	DFA, SFV	-	Vein-long saphenous vein	Wound Gaping Femoral Artery blowout	Wound Debride ment	Pleomorphic RMS High Grade	-ve	Concordance	-	Fair	-
23	Elango	Wide Local Excision	DFA	-	-	Marginal flap nnecrosis	Secon dary suturing	Liposarcoma High grade	-ve	Concordance	RT	Good	-
24	Ganesan	Wide Local Excision	-	Reverse Sural Artery	-	Marginal flap nnecrosis	Wound Debride ment	Hemangio pericytoma	-ve	Concordance	-	Good	-
25	Mangalam	Wide Local Excision	-	Posterior Thigh	-	Marginal flap nnecrosis	Skin graft	Angiosarcoma	-ve	Concordance	RT	Good	-
26	Ponmuthu	Wide Local Excision	-	Gastroc nemius flap	-	-	-	DFSP	-ve,	Concordance	-	Good	Local
27	Laxmanan	Wide Local Excision	-	Gastroc Nemius	-	-	-	Fibrosarcoma High Grade	-ve	discordance	RT	Good	-
28	Chandrasekar	Compart mental excision	-	-	-	-	-	liposarcoma low grade	-ve	Concordance	-	Good	-
S. No	**Name**	**Surgery**	**Vascular /Bone/ nerve resection**	**Recons truction Skin/soft tissue**	**Vascular/ Bone Recons truction**	**Compli cations**	**Second surgery**	**Post op HPE Grade**	**Mar gin**	**HPE Concor dance/ discordance**	**Adju vant**	**Post operative function**	**Recu rrence/ site**
29	Sundarajan	Wide Local Excision	-	-	-	-	-	Liposarcoma Low grade	-ve	Concordance	-	Good	-
30	Moovendan	Wide Local Excision	-	-	-	-	-	MPNST Low garde	-ve	Concordance	-	Good	-
31	Nagaraj	Wide Local Excision	-	SSG	-	-	-	MPNST Low grade	-ve	discordance	-	Good	-

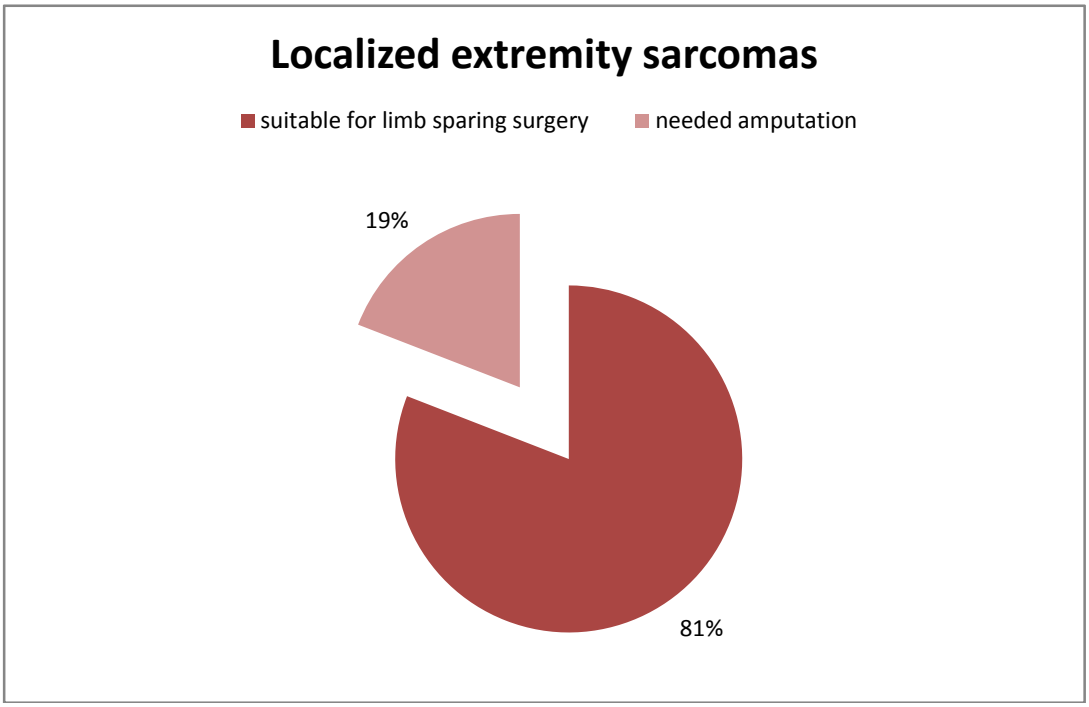
32	Melambal	Wide Local Excision	-	-	-	-	-	Liposarcoma Low grade	-ve	Concordance	RT	Good	-
33	Abdulla	Wide Local Excision	-	Gastroc nemius, SSG	-	-	-	No residual Tumor	-	-	-	Good	Local-10 months
34	Phuspha	Wide Local Excision	-	-	-	-	-	DFSP	-ve	Concordance	-	Good	-
35	Sankara pandian	Wide local excision	-	SSG	-	-	-	MFH Low Grade	-ve	Concordance	-	Good	-
36	Nagarajan	Compart mental excision	-	Tendon transfer	-	Marginal flap Necrosis Edema leg	Secon dary suturing	MFH High Grade	-ve	discordance	RT	Good	-
37	Guna	Wide local excision & node dissection	Clavicle	Latissmus Dorsi flap	-	-	-	MPNST Low grade	-ve	Concordance	-	Good	-
38	Banumathy	Wide local excision	-	-	-	-	-	Liposarcoma Low grade	-ve	Concordance	-	Good	-
39	Ramkannan	Wide local excision	calcaneu m	Reverse sural artery	-	Marginal flap necrosis	Wound debride ment	Synovial sarcoma Low grade	clos e	Concordance	-	Good	-
S. No	**Name**	**Surgery**	**Vascular /Bone/ nerve resection**	**Recons truction Skin/soft tissue**	**Vascular/ Bone Recons truction**	**Compli cations**	**Second surgery**	**Post op HPE Grade**	**Mar gin**	**HPE Concor dance/ discordance**	**Adju vant**	**Post operative function**	**Recu rrence/ site**
40	Elumalai	Wide local excision	-	Mesh	-	Seroma	-	Liposarcoma low Grade	-ve	Concordance	RT	Good	-
41	Krishnan	Wide local excision	-	PMMC Flap	-	-	-	MFH, Low Grade	-ve	discordance	RT	Fair	-
42	Manickam	Wide local excision& node dissection	-	Skin graft	-	Marginal flap necrosis	Wound debri ment	Spindle cell sarcoma Low garde	-ve	Discordance	Chemo	Good	-
43	Parvathy	Wide local excision	-	-	-	-	-	Liposarcoma Low Grade	-ve	Concordance	RT	Good	-
44	Thilagavathy	Muscle group excision	-	Tendon transfer	-	Marginal flap necrosis	Wound debri ment	Liposarcoma Low Grade	-ve	Discordance	-	Fair	-
45	Sundar	Wide local excision	-	-	-	-	-	MPNST Low grade	-ve	Discordance	RT	Fair	-
46	Amaravathy	Wide local excision	-		-	-	-	No residual tumor	-	-	RT	Fair	-
47	Duraisamy	Wide local excision	Ulnar nerve	-	-	Seroma	-	Neurofibro Sarcoma-LG	-ve	Discordance	RT	Good	-
48	Thangaraj	Wide local excision	SFA, SFV	-	Artery-Long sapheno us vein	Infection Woung Gaping Edemaleg	Secon dary suturing	MPNST high grade	-ve	Concordance	RT, Chemo	Fair	-
49	Usha	Wide local excision	SFA, SFV	-	Artery& veinlong sapheno	Infection Woung Gaping	Secon dary suturing	MFH, Low Grade	-ve	Concordance	RT	Good	-

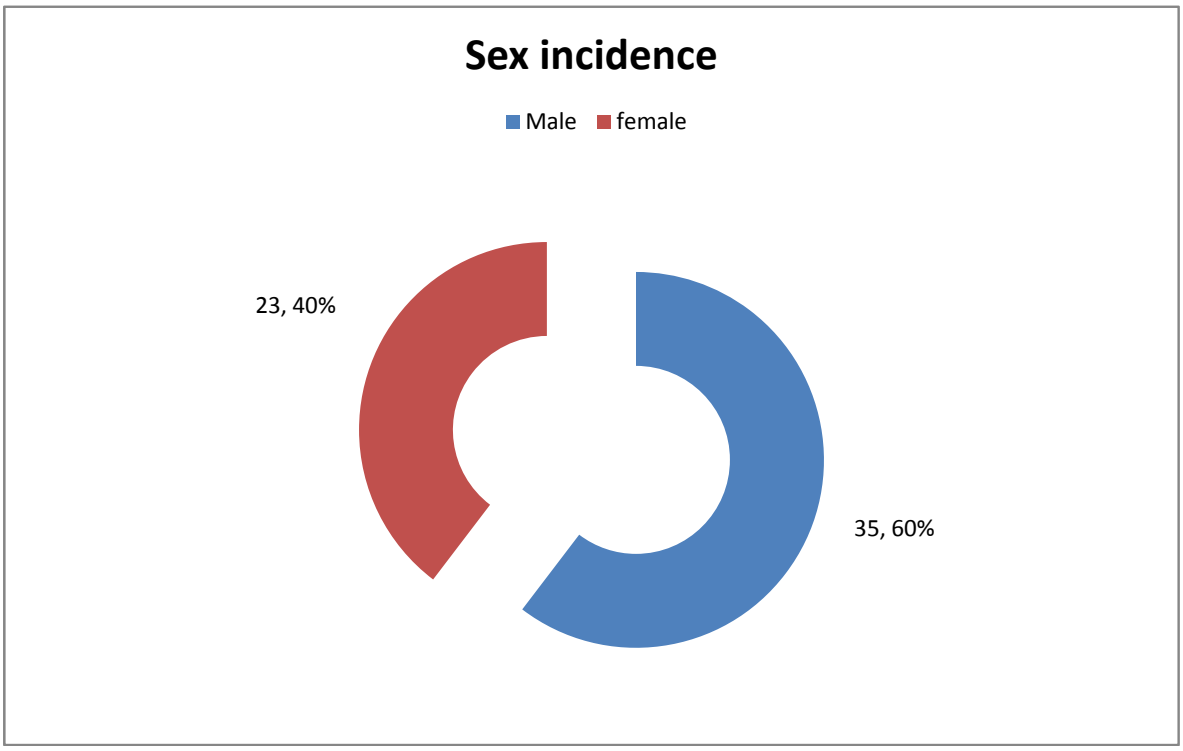
					us vein	Edemaleg							
S. No	**Name**	**Surgery**	**Vascular /Bone/ nerve resection**	**Recons truction Skin/soft tissue**	**Vascular/ Bone Recons truction**	**Compli cations**	**Second surgery**	**Post op HPE Grade**	**Mar gin**	**HPE Concor dance/ discordance**	**Adju vant**	**Post operative function**	**Recu rrence/ site**
50	Narayanan	Wide local excision	-	-	-	-	-	No residual Tumor	-	-	-	Excellent	-
51	Ilaiyaraja	Wide local excision	-	Trans Position Flap	-	Marginal flap necrosis	Skin graft	Spindle cell Sarcoma Low grade	-ve	Concordance	-	Good	-
52	Govindasamy	Wide local excision	Bone	Latissmus Dorsi flap	Mesh	-	-	Extraskeletal Chondro sarcoma	-ve	Concordance	-	Poor	-
53	Prabha	Compart mental excision	DFA	Tendon Transfer	-	Marginal flap necrosis	Skin Graft	Liposarcoma Low grade	-ve	Concordance	-	Fair	-
54	Thangam	Wide local excision	Ulna, radius	Abdominal Flap	Plate	Marginal flap necrosis	Skin Graft	MPNST Low grade	-ve	Concordance	-	Fair	-
55	Flori	Wide local excision	-	Trans Position Flap	-	-	-	Extraskeletal Chondro sarcoma	-ve	Concordance	-	Good	-
56	Ramani	Wide local excision	-	Skin graft	-	-	-	MPNST High grade	-ve	discordance	-	Excellent	-
57	Abdull sukur	Wide local excision	-	Mesh, Latissmus Dorsi flap	-	Marginal flap necrosis	flap	MFH High grade	-ve	discordance	-	Poor	-
58	Palanivel	Wide local excision	-	-	-	-	-	Liposarcoma Low grade	-ve	discordance	-	good	-

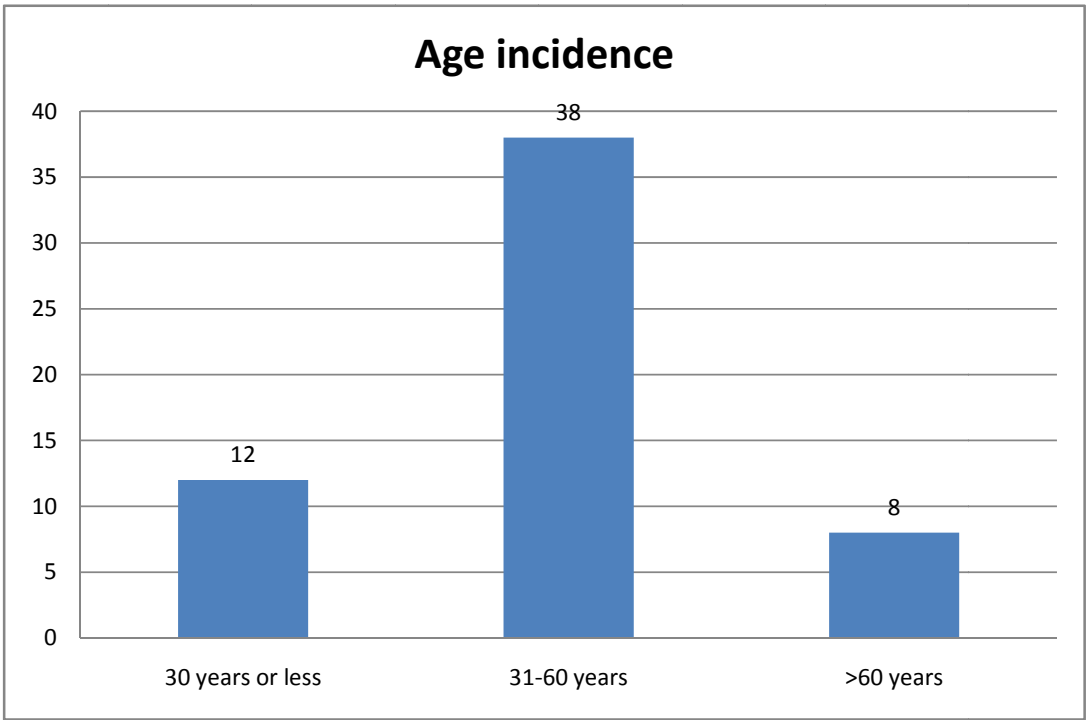
Abbereviations: DFA- deep femoral artery, SFA-supeficial femoral artery, SFV-superficial femoral vein, MFH- ma
histiocytoma, MPNST-malignant peripheral nerve sheath tumor, -ve- negative, LG- low grade, RT-radiotherapy, ch
HPE-histopathologiical examination,

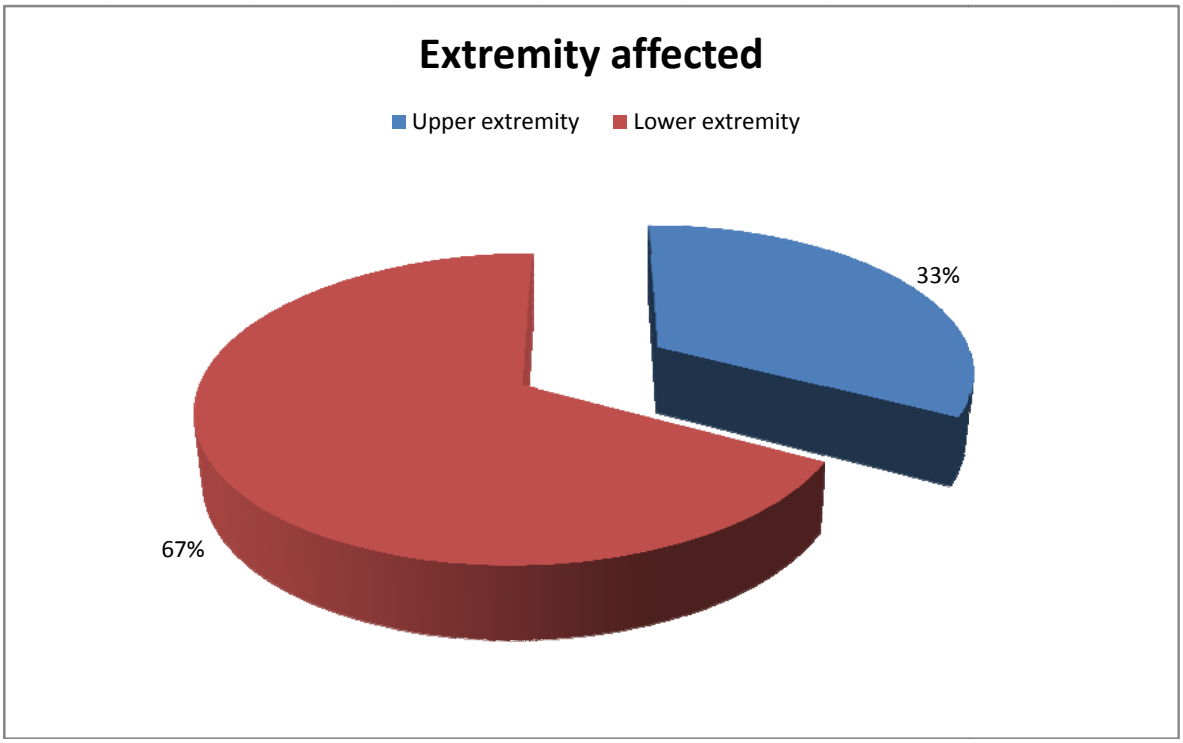

Soft tissue sarcoma- site distribution
extremity soft tissue sarcomas
0ther sites
43%
57%

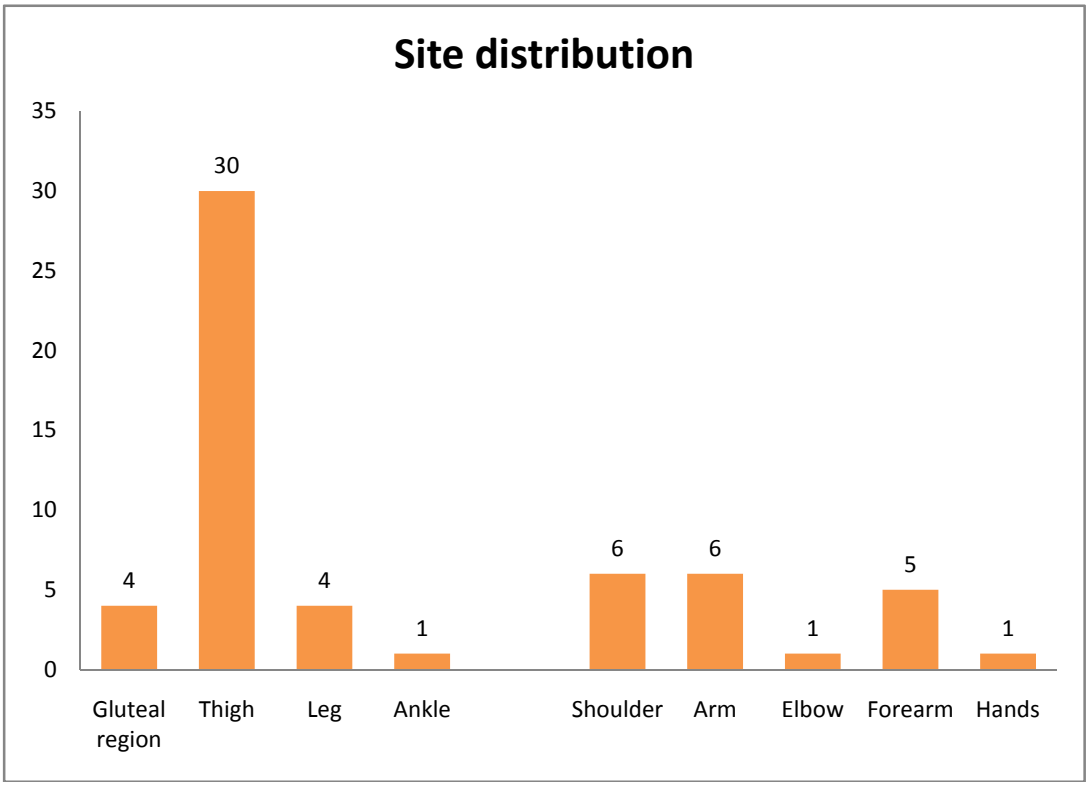

Presentation on diagnosis
Localized
Metastatic
27%
73%

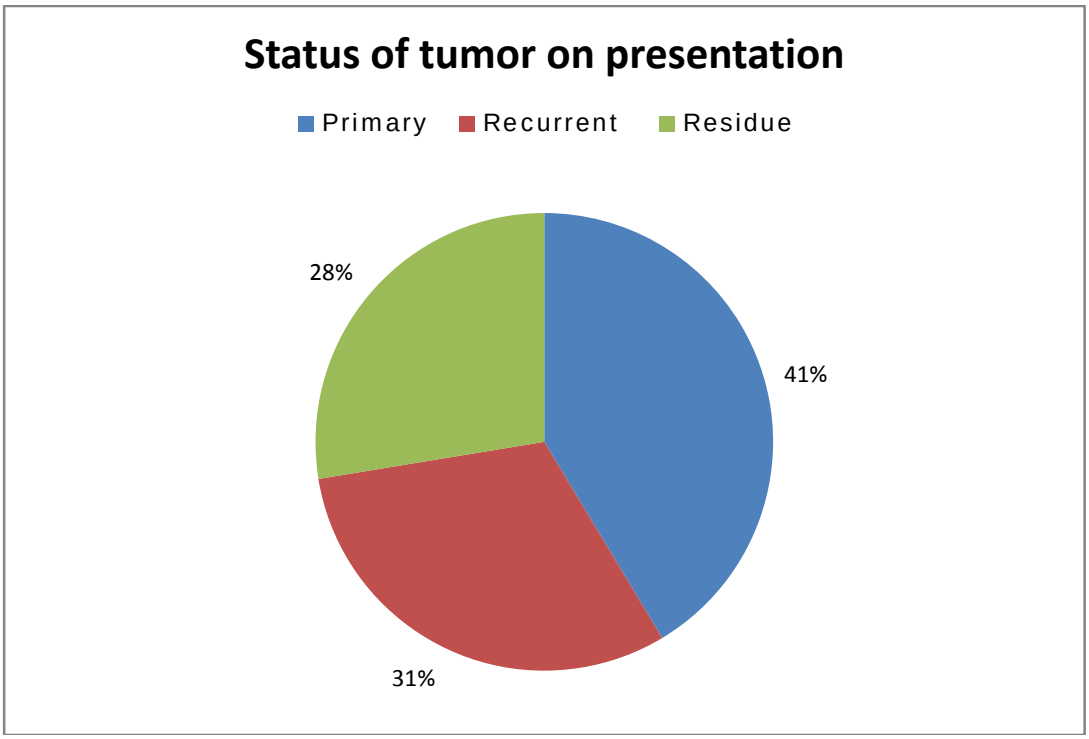

Localized extremity sarcomas
suitable for limb sparing surgery
needed amputation
19%
81%

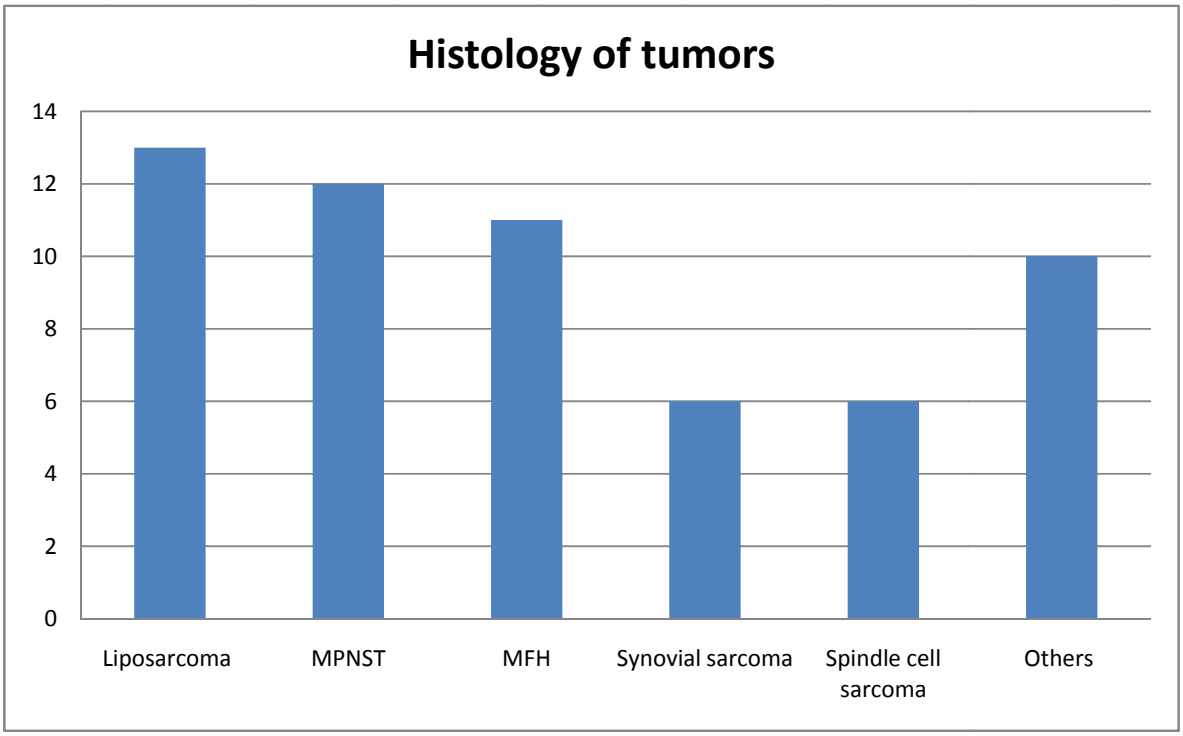

Sex incidence
Male
female
23, 40%
35, 60%

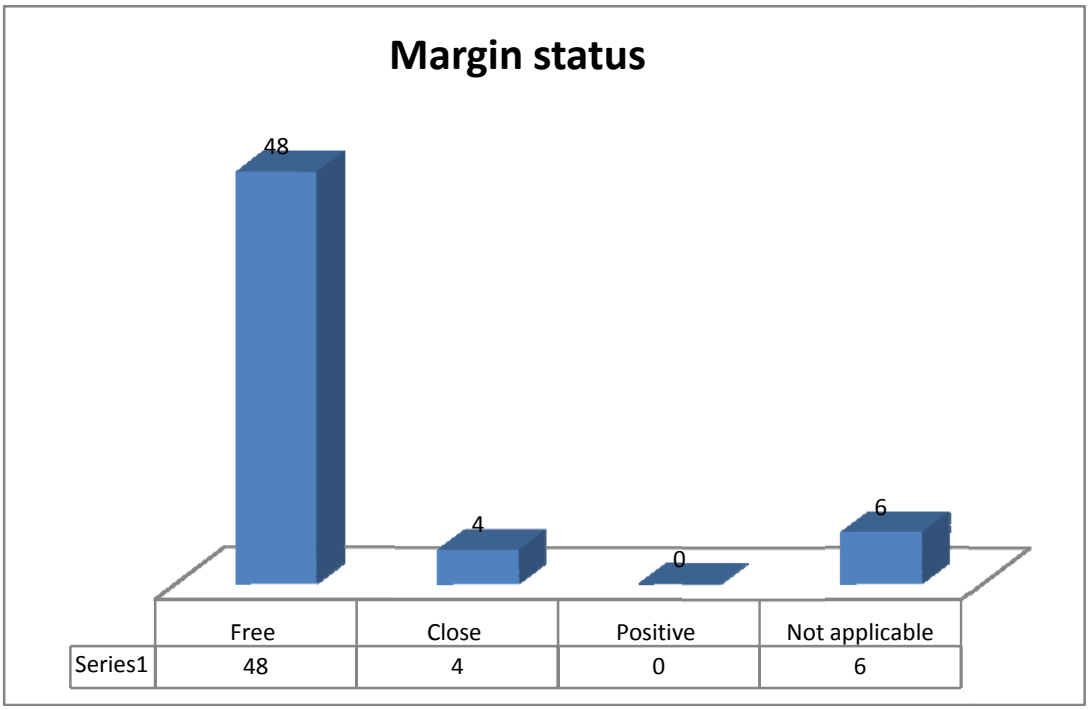

Age incidence
40
35
30
25
20
15
10
5
0
38
12
8
30 years or less
31-60 years
>60 years

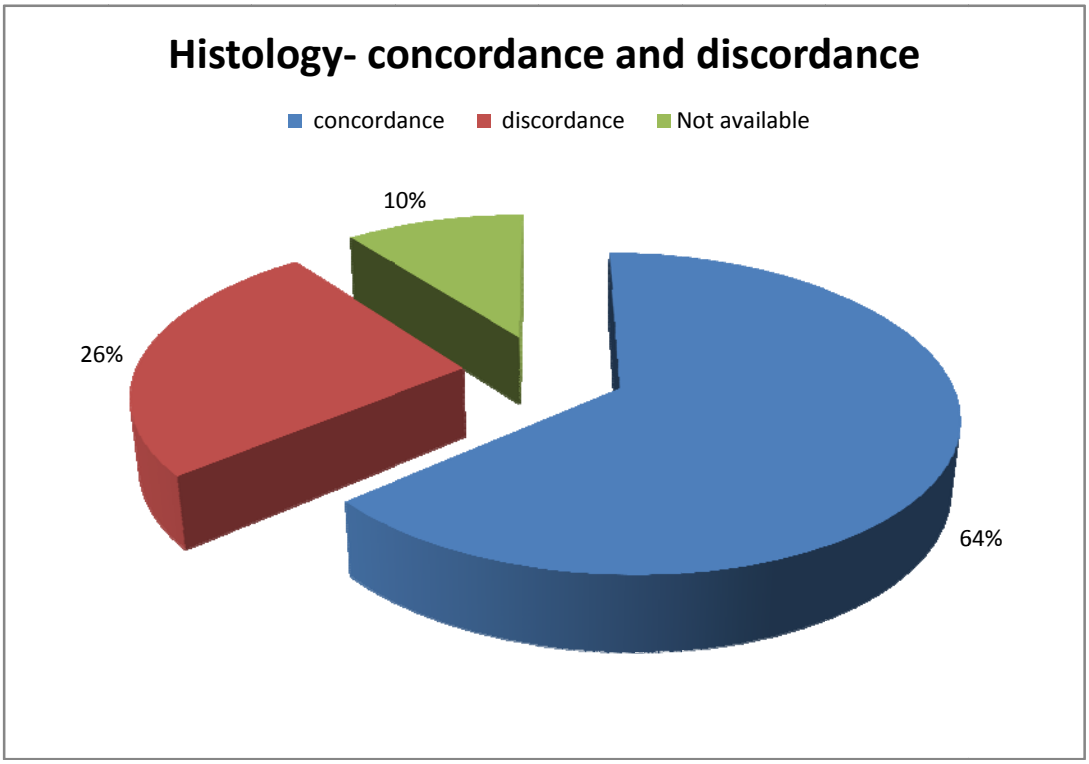

Extremity affected
Upper extremity
Lower extremity
33%
67%

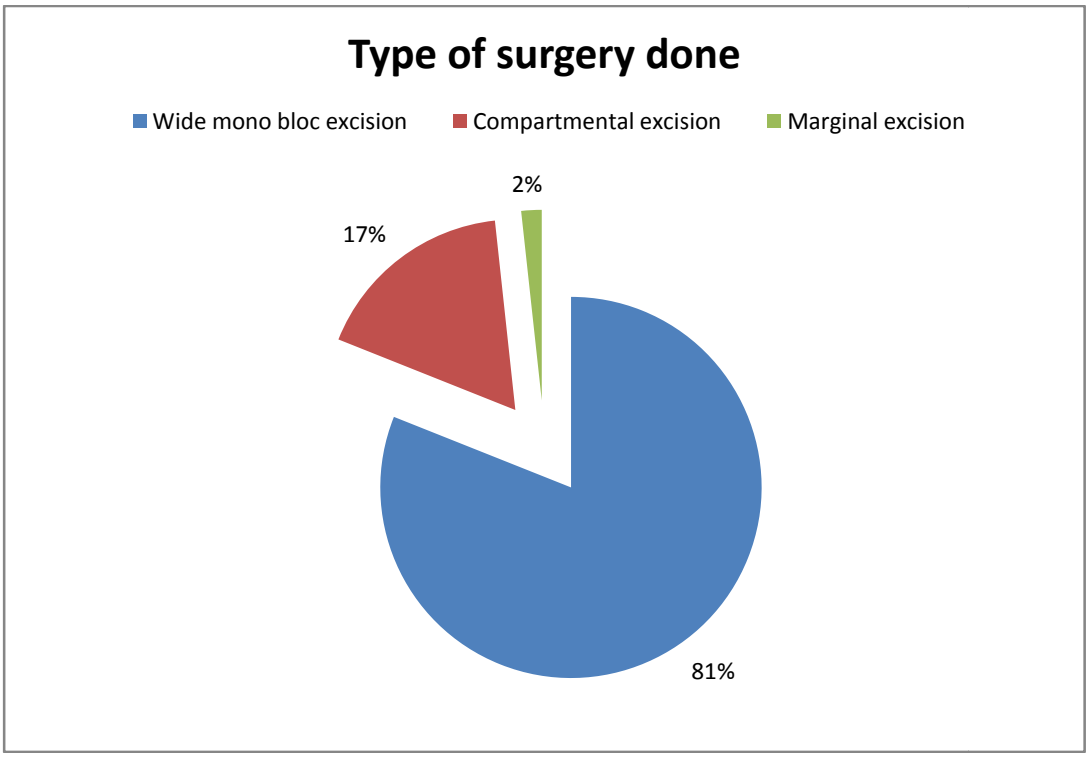

Site distribution
35
30
25
20
15
10
5
0
4
30
4
1
6
6
1
5
1
Gluteal region
Thigh
Leg
Ankle
Shoulder
Arm
Elbow
Forearm
Hands

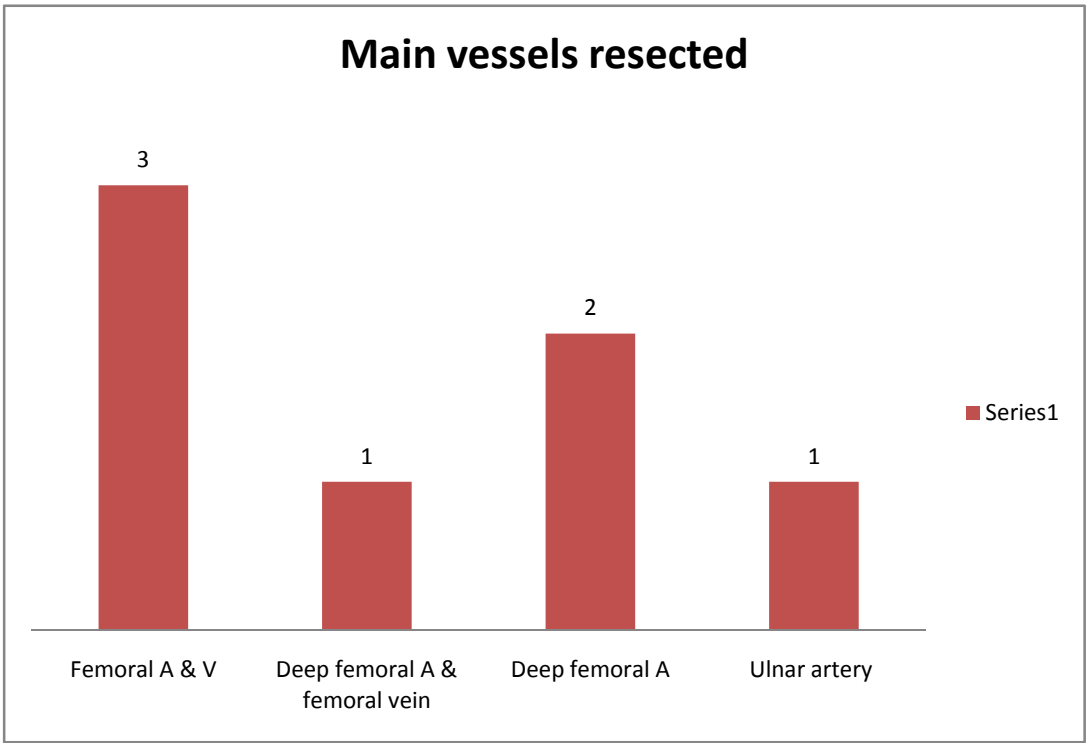

Status of tumor on presentation
Primary
Recurrent
Residue
28%
41%
31%

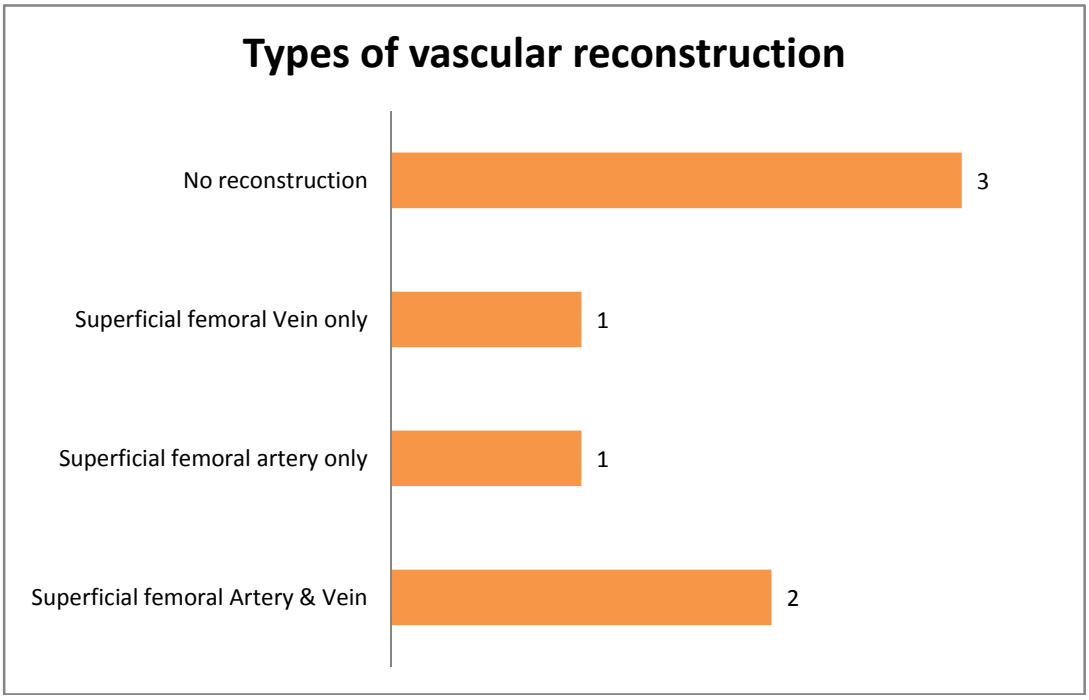

Histology of tumors
14
12
10
8
6
4
2
0
Liposarcoma
MPNST
MFH
Synovial sarcoma
Spindle cell sarcoma
Others

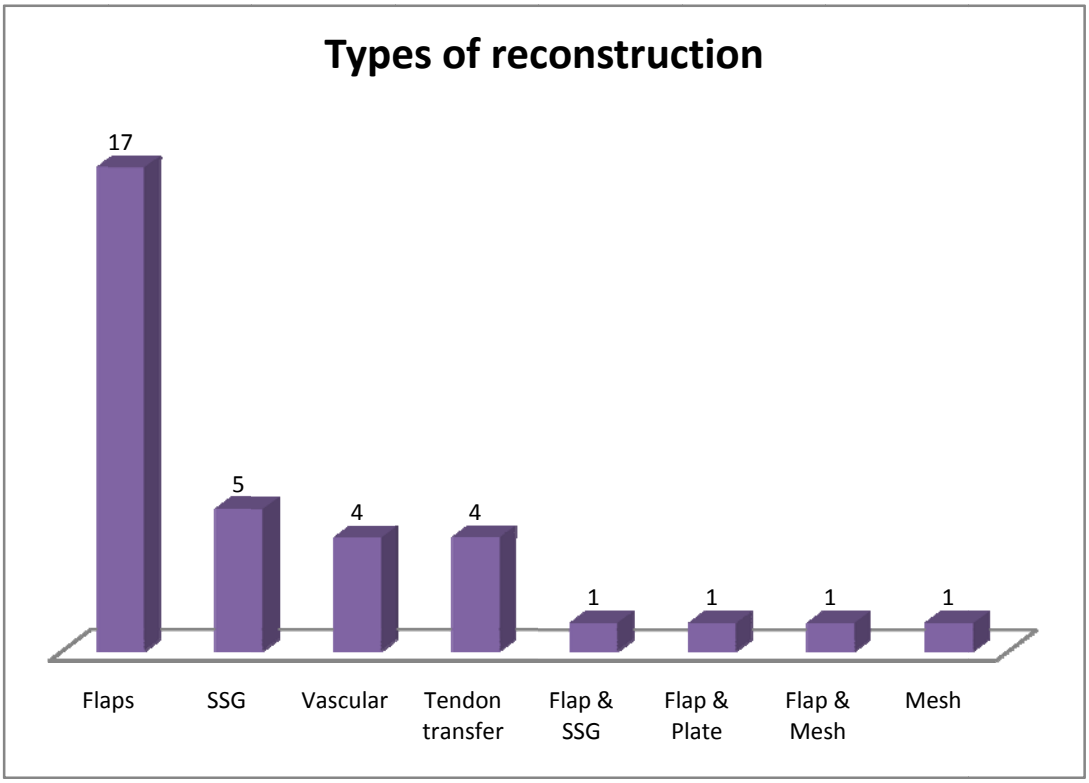

Margin status
48
4
0
6
Free
Close
Positive
Not applicable
Series1
48
4
0
6

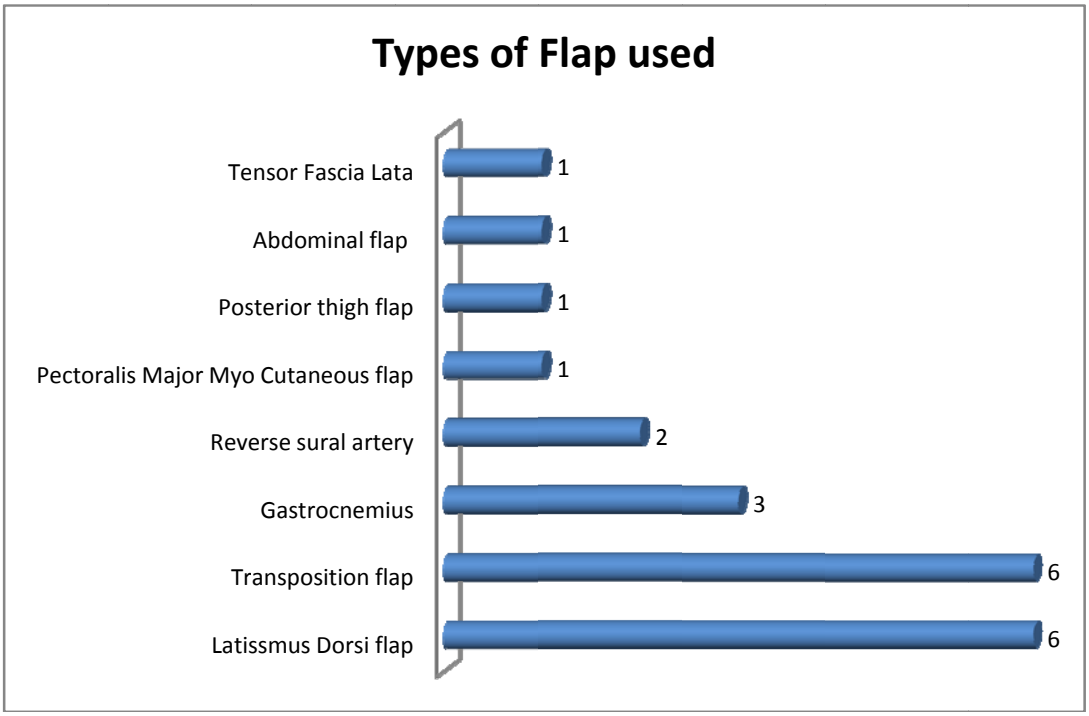

Histology- concordance and discordance
concordance
discordance
Not available
10%
26%
64%

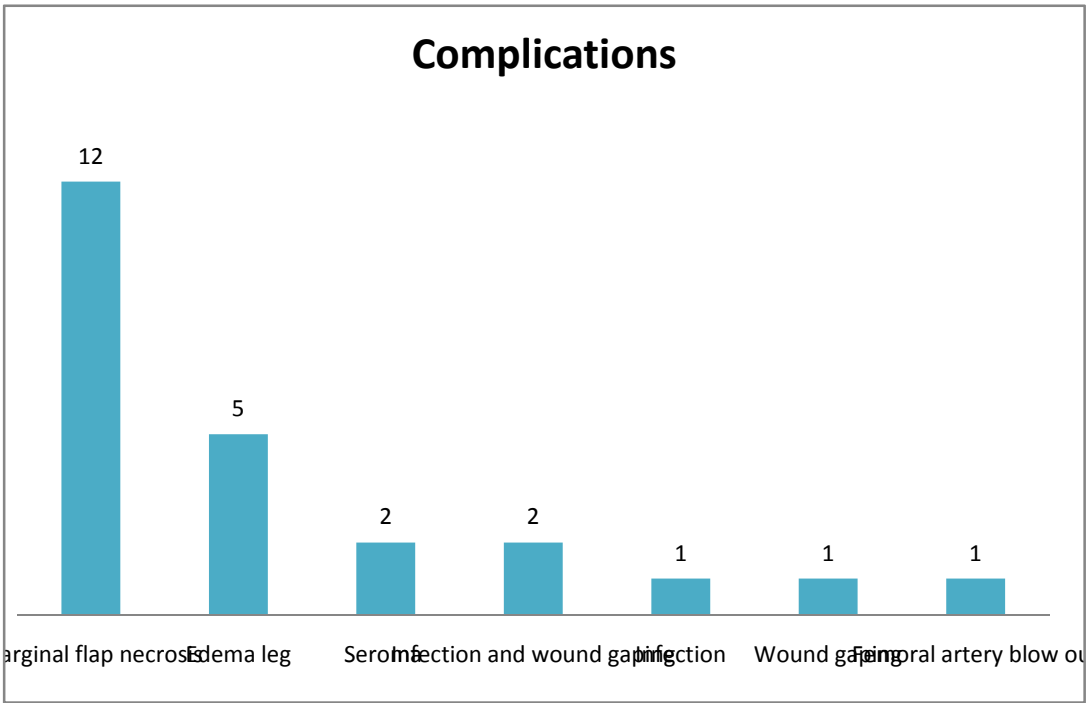

Type of surgery done
Wide mono bloc excision
Compartmental excision
Marginal excision
2%
17%
81%

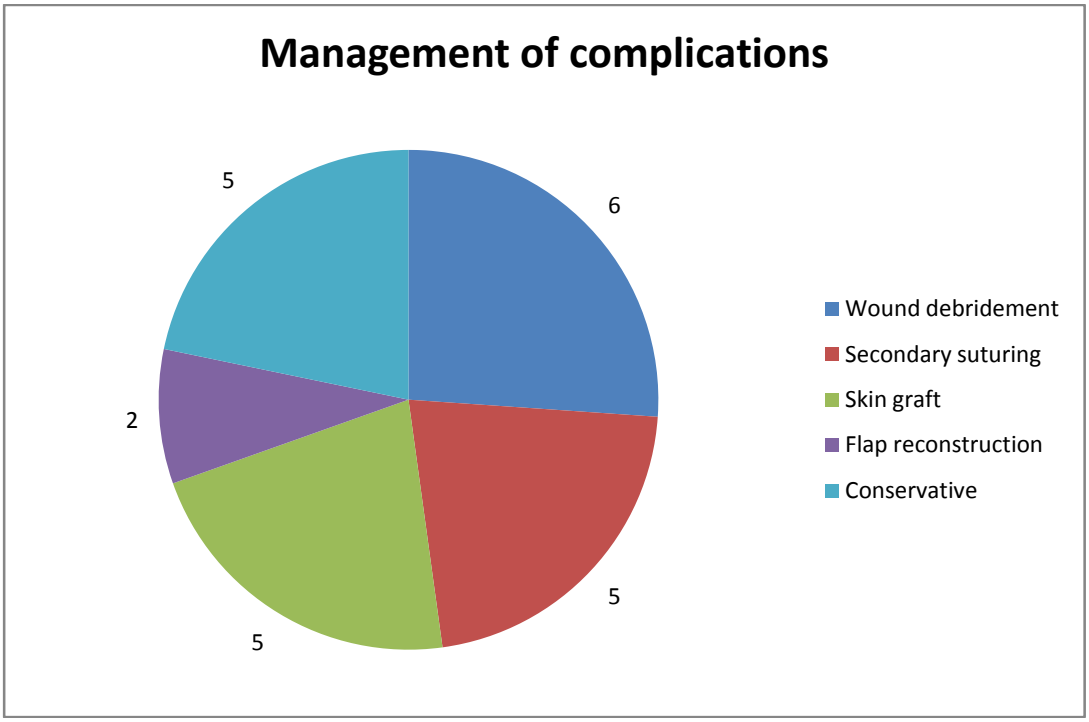

Main vessels resected
3
1
2
1
Series1
Femoral A & V
Deep femoral A & femoral vein
Deep femoral A
Ulnar artery


Types of vascular reconstruction
No reconstruction
3
Superficial femoral Vein only
1
Superficial femoral artery only
1
Superficial femoral Artery & Vein
2


Types of reconstruction
17
5
4
4
1
1
1
1
Flaps
SSG
Vascular
Tendon transfer
Flap & SSG
Flap & Plate
Flap & Mesh
Mesh

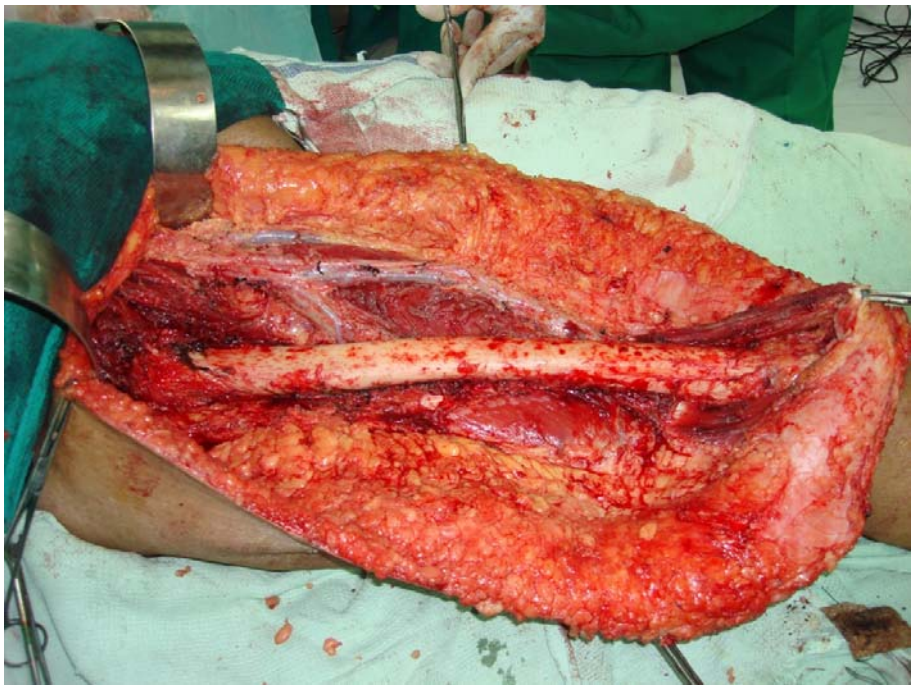

Types of Flap used
Tensor Fascia Lata
1
Abdominal flap
1
Posterior thigh flap
1
Pectoralis Major Myo Cutaneous flap
1
Reverse sural artery
2
Gastrocnemius
3
Transposition flap
6
Latissmus Dorsi flap
6


Complications
12
5
2
2
1
1
1
arginal flap necros
Edema leg
Sero
Infection and wound gap
infection
Wound gaping
Femoral artery blow ou

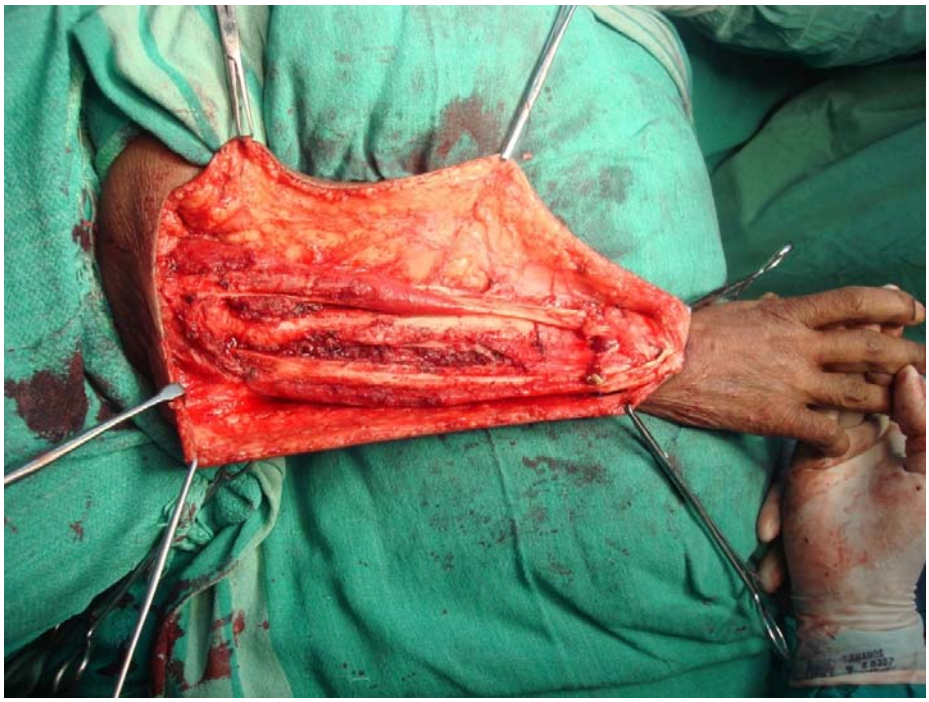

Management of complications
6
5
5
2
5
Wound debridement
Secondary suturing
Skin graft
Flap reconstruction
Conservative

CT Scan Left thigh showing typical fat density suggestive of liposarcoma

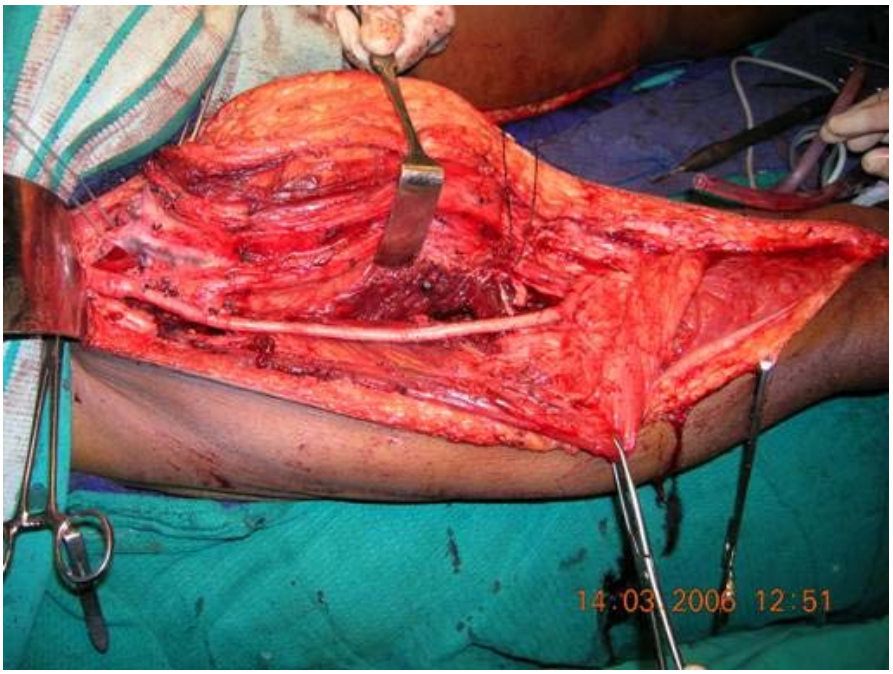
MRI Left thigh showing mass infiltrating the femoral vessels



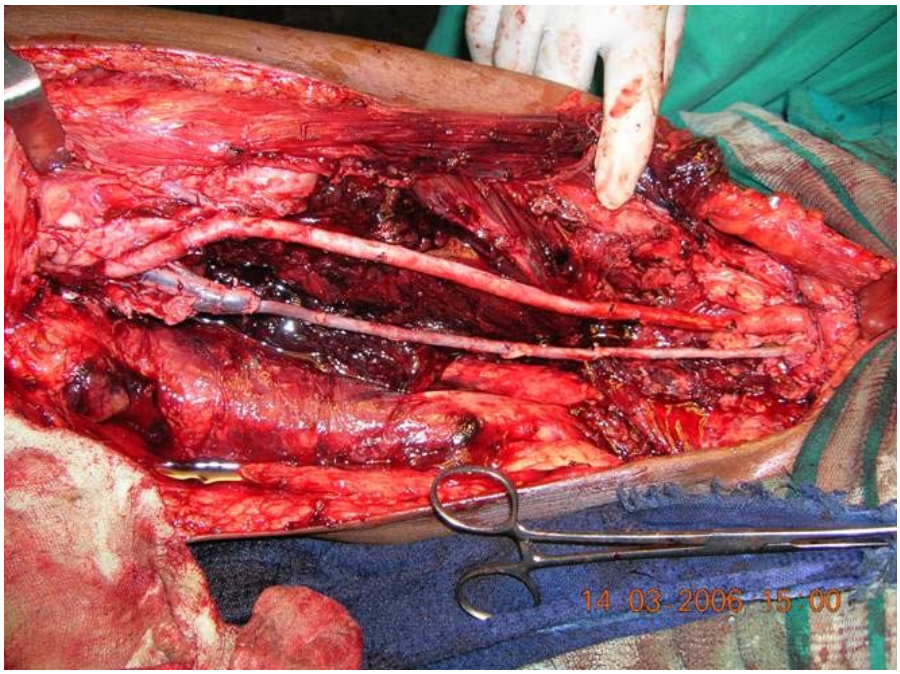
Peroperative photograph showing anterior compartmental resection of soft tissue sarcoma right thigh



Muscle group excision - forearm



Soft tissue sarcoma right thigh infiltrating superficial femoral vein



Vascular reconstruction of superficial femoral vein

Upper humeral resection in soft tissue sarcoma of right shoulder

Rreconstruction with skin graft after excision of recurrent sarcoma of right thigh

Latissmus dorsi flap reconstruction